CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental assessment (EA) provides an analysis of the potential environmental consequences that would result from implementation of the proposed Copper Ridge Shallow Gas project. Certain measures that would avoid or reduce impacts under the Proposed Action have been included in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter for each resource discipline.

An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the proposed action or alternatives to the proposed action. Impacts can be direct or indirect in nature, and can be permanent (long-term) or temporary (short-term). Impacts can vary in degree ranging from only a slight discernable change to a drastic change in the environment. Short-term impacts are impacts that occur during and immediately after construction and testing and last from two to five years. For purposes of this EA, short-term impacts are defined as lasting five years or less. Long-term impacts are impacts imposed by construction and operations that remain longer than five years and extend for the life of the project and beyond.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Impacts The level and duration of impacts that would occur as a result of the Proposed Action or the No Action Alternative. The impact evaluation assumes that the applicant-committed practices described in Chapter 2 would be implemented. Direct impacts are those which are caused by the action and occur at the same time and place. Indirect impacts are those impacts which are caused by the action but occur later in time or farther removed in distance.

Mitigation - A summary of additional measures that could be applied to avoid or reduce impacts. Mitigation items specified in the Mitigation Summary are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, it would be up to Anadarko to determine which measures would be applied, to what degree, and where on their privately-owned lands. Anadarko would coordinate with the State of Wyoming as to application of mitigation on state-owned lands. The measures identified under this section would be considered for application on public lands administered by the BLM. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts - A summary of impacts that are unavoidable and cannot be reduced or eliminated through the application of available and reasonable mitigation and, therefore, would remain throughout the duration of the project and to some point beyond.

Cumulative Impacts - A description of impacts likely to occur due to this project in combination with other on-going and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable

developments or RFDs). Cumulative impacts associated with the Proposed Action and alternatives are summarized in Chapter 5 of this EA.

Unavoidable adverse impacts, short-term use of the environment versus long-term productivity, and irreversible and irretrievable commitment of resources are discussed in separate sections following the discussions of the specific resources (Sections 4.16, 4.17, and 4.18 respectively). Unavoidable adverse impacts cannot be avoided and cannot be completely mitigated. Short-term use of the environment covers the life-of-project (LOP), whereas long-term productivity refers to the period after the project is completed and the area reclaimed. Irreversible and irretrievable impacts are permanent reductions or losses of resources that, once lost, cannot be regained.

4.1 GEOLOGY/MINERALS/PALEONTOLOGY

4.1.1 Geology

4.1.1.1 Impacts

4.1.1.1.1 Proposed Action

Impacts could occur to the geologic environment as a result of Proposed Action if alteration of existing land surface steepens slopes or otherwise increases runoff or causes undercutting that could initiate slumping, landslides or other mass movements. This is particularly true in the eastern part of the area along Six Mile Rim, where relief is greatest. If existing BLM construction restrictions on slopes and construction design described in Chapter 2 are followed the possibility of the project initiating landslides or other mass movements, flooding is considered unlikely.

Impacts could occur to the geologic environment as well as project facilities as a result of inherent geologic hazards (e.g., landslides, mass movements, earthquakes), but this is considered unlikely. The low eastward dips on the rocks at the surface and relatively low relief, except in the eastern part of the area along Six Mile Rim, lessens the chance for naturally occurring mass movements. In addition, no landslides or mass movement deposits occur within the project and no earthquake epicenters have been documented within 10 miles of the project area.

4.1.1.1.2 No Action Alternative

Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas Conservation Commission approval. Impacts to the geological environment would be similar to those described under the Proposed Action, but to a lesser extent.

4.1.1.2 Mitigation

No additional mitigation to the geologic environment is required.

4.1.1.3 Residual Impacts

No residual impacts to the geologic environment are identified.

4.1.2 Minerals

4.1.2.1 Impacts

4.1.2.1.1 Proposed Action

Natural gas is the only mineral resources that would be impacted with implementation of the Proposed Action. Production of natural gas would deplete reserves, but the proposed project allows for recovery of Federal natural gas resources per 43CFR 3162(a) and generation of private and public revenues.

4.1.2.1.2 No Action Alternative

Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas Conservation Commission approval. Impacts to the mineral resources would be similar to those described under the Proposed Action, but to a lesser extent. Additionally, loss of federal energy resources, and therefore royalties, could occur due to drainage for wells located on private lands.

4.1.2.2 Mitigation

No mitigation to the mineral environment is required.

4.1.2.3 Residual Impacts

Depletion of natural gas reserves is an unavoidable impact associated with implementation of the Proposed Action. Drilling of wells however, may result in the identification of additional as yet unknown gas reserves, and allow the orderly development of gas reserves in the Copper Ridge Unit.

4.1.3 Paleontology

4.1.3.1 Impacts

4.1.3.1.1 Proposed Action

Impacts could occur to paleontology resources if surface disturbance associated with the Proposed Action results in exposure and destruction of important fossil resources, along with associated loss of geologic information. Mitigation measures under the Proposed Action could result in new and scientifically important fossil resources being discovered and properly recovered and cataloged into the collection of a museum repository, so that they are available for study.

Early Tertiary (Eocene) aged sedimentary deposits represented by the Green River Formation, Wasatch Formation, and Fort Union Formation underlie the project area. All of these formations

either have produced or have the potential to produce vertebrate fossils of scientific significance either in the area itself or surrounding area. The potential for discovery is greatest where the formations crop out at the surface as depicted in Figure (soils figure), where surface weathering has concentrated fossil remains. However, the potential for the discovery extends throughout the formations, either in the subsurface or surface.

4.1.3.1.2 No Action Alternative

Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas Conservation Commission approval. Impacts to the paleontological resources would be similar to those described under the Proposed Action, but to a lesser extent.

4.1.3.2 Mitigation

No additional mitigation would be required.

4.1.3.3 Residual Impact

It is anticipated that some fossils will be destroyed during construction activities because they were not seen or reported, however implementation of the recommended mitigation measures will reduce the magnitude of impact to the extent possible.

4.2 AIR QUALITY

4.2.1 Impacts

4.2.1.1 Proposed Action

4.2.1.1.1 Summary

Proposed Action emission sources would include those resulting from well development, well production, and gas compression and processing. This includes increased vehicle traffic and drilling activity during the construction phase of the Proposed Action, followed by continuous well pump and natural gas compression emissions. Air pollutant emissions from these sources would include oxides of nitrogen (NO_X), carbon monoxide (CO), particulate matter less than 10 and 2.5 microns in effective diameter (PM_{10}, $PM_{2.5}$) and volatile organic compounds (VOCs). Results indicate that formaldehyde would be the only hazardous air pollutant (HAP) emitted from the Proposed Action sources. Emissions of benzene, toluene, ethylbenzene and xylenes (BTEX) compounds would be inconsequential due to the composition of the produced gas.

Total estimated emissions for the Proposed Action are summarized in Table 4-1. All development related emission calculations which include well pad and resource road construction, well drilling, and well completion, assume maximum development at the rate of 45 wells per year over a two-year period.

The individual sources of Proposed Action related emissions are discussed below. Detailed emission calculations for each activity are available in the BLM's RSFO project file.

Table 4-1. Proposed Action Emission Summary

Pollutant	Emissions (tons/year) Well Development	Well Production	Well Subtotal	Gas Compression and Processing	Total Estimated Emissions (tons/year)
NO_X	52.7	51.6	104.3	174.7	279.0
CO	14.7	51.6	66.3	116.5	182.8
VOC	4.7	16.1	20.8	58.2	79.0
SO_2	0.9	0.0	0.9	0.0	0.9
PM_{10}	64.6	9.7	74.3	0.0	74.3
$PM_{2.5}$	13.1	3.9	17.0	0.0	17.0
Benzene	0.0	0.0	0.0	0.0	0.0
Toluene	0.0	0.0	0.0	0.0	0.0
Ethylbenzene	0.0	0.0	0.0	0.0	0.0
Xylene	0.0	0.0	0.0	0.0	0.0
n-Hexane	0.0	0.0	0.0	0.0	0.0
Formaldehyde	0.1	2.6	2.6	8.2	10.8

Construction, Drilling, and Well Development Emissions

During the construction phase, vehicle and fugitive dust emissions would increase within the Proposed Action area. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of construction equipment. Vehicle tailpipes would emit small quantities of NO_X and CO. Fugitive dust concentrations would increase with additional vehicle traffic on unpaved roads and from wind erosion in areas of soil disturbance. Drill rig operations would result mainly in an increase of NO_X and CO emissions. Emission rates were calculated using applicable EPA emission factors and anticipated level of operational activities, such as estimated vehicle trips, load factors, and hours of operation.

Development emissions would be in addition to the vehicle emissions generated from existing operations within the Proposed Action area. However, because of the limited scope (restricted to locations where construction is actively taking place) and the short-term nature of these emissions (two year development period), the aggregate impact of vehicle tailpipe, fugitive dust, and drill rig emissions would be minimal over the life of the Proposed Action. Based on the analysis of results from larger actions such as the Draft Environmental Impact Statement/Draft Planning Amendment for the Powder River Basin Oil and Gas Project and the Desolation Flats Natural Gas Field Development Project Environmental Impact Statement (Bureau of Land Management 2003; Bureau of Land Management 2002), well development sources are not predicted to have substantial effects on air quality within the Proposed Action area or the surrounding cumulative assessment area.

Compressor Engines and Well Pumps

Two natural gas compressor stations, each consisting of five 1206 hp compressors and one dehydrator would be constructed and operated. For analysis purposes, it was assumed that

Caterpillar 3516 TALE compressor engines would be utilized. The compressors represent the primary Proposed Action source of NO_X and CO emissions at 174.7 and 116.5 tons per year, respectively. The dehydrator burner emissions are assumed to be inconsequential at less than one ton per year of NO_X and CO. The compressors and dehydrators would also emit lesser amounts of VOCs.

According to the project proponent, each well would require a pump rated at up to 30 hp, for a total power requirement of 2670 hp. The well pumps may be directly driven by natural gas-fueled engines or consist of electric pumps powered by natural gas-fueled generators. At emission rates of 2 grams per horsepower-hour, well pumps are estimated to account for 51.6 tons per year of both NO_X and CO emissions.

4.2.1.1.2 Criteria Pollutant Impacts

The latest version of the AERMOD-PRIME dispersion model was applied to predict maximum criteria pollutant and formaldehyde air quality impacts. Proposed Action sources included in the modeling analysis were compressor engines and well pumps. Five years of Rock Springs surface and corresponding Lander upper air meteorological data (1985, 1987-1990) were utilized in the modeling analysis. Adjustments to annual predicted NO_x concentrations were made in accordance with the Ambient Ratio Method (ARM) as specified in EPA's Guideline on Air Quality Models (EPA 2003). The ARM accounts for the atmospheric conversion of nitric oxide (NO) to nitrogen dioxide (NO_2).

The Proposed Action sources were evaluated against significance criteria for NO_x and CO emissions. Tables 4-2 and 4-3 compare the maximum predicted air quality impacts with the appropriate National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Class II increments. Since there are no PSD increments for CO, only the NO_2 increment is presented in Table 4-3. As shown, the predicted impacts are substantially less than the applicable NAAQS and PSD Class II increments.

Table 4-2. Proposed Action Impact Comparison to NAAQS

Pollutant and Averaging Time	Maximum Proposed Action Impact (:g/m^3)	Background Concentration (:g/m^3)	Maximum Proposed Action Impact Plus Background (:g/m^3)	National and Wyoming Ambient Air Quality Standard (:g/m^3)	Percent of NAAQS
NO_2 Annual	12.6	3.4[a]	16.0	100	16.0%
CO 1-hour	95.1	2,299[b]	2394.1	40,000	6.0%
CO 8-hour	82.0	1,148[b]	1230.0	10,000	12.3%

[a] Data collected at Green River Basin Visibility Study site, Green River, Wyoming during the period June 10, 1998 – December 31, 2001 (ARS 2002)

[b] Data collected at Rifle and Mack, Colorado in conjunction with proposed oil shale development during the early 1980's (CDPHE-APCD 1996)

Table 4-3. Proposed Action Impact Comparison to PSD Increments

Pollutant and Averaging Time	Maximum Proposed Action Impact (□g/m^3)	PSD Class II Increment (□g/m^3)	Percent of Increment
NO_2 Annual	12.6	25	50.4%

4.2.1.1.3 Hazardous Pollutant Impacts

Hazardous Air Pollutant (HAP) emissions were evaluated for both long-term (chronic) health effects and carcinogenic effects. Test results indicate the absence of typical HAP constituents in the gas stream that would be processed through the dehydrators. However, low levels of formaldehyde (CH_2O) would be emitted from the compressor engines and well pump sources.

To assess the potential health effects of formaldehyde exposure, predicted concentrations were compared to reference concentrations (RfCs) for chronic exposure (EPA 2002). The RfCs represent an estimate of the continuous inhalation exposure rate to the human population (including sensitive subgroups such as children and the elderly) without an appreciable risk of harmful effects during a lifetime.

For the Proposed Action, the maximum predicted formaldehyde concentration represents a small percentage of the RfC, as illustrated in Table 4-4 below, indicating that no chronic adverse health effects would be expected.

Table 4-4. Formaldehyde Reference Concentration Comparison

Hazardous Air Pollutant	Reference Concentration (RfC) (µg/m^3)	Maximum Predicted Concentration (µg/m^3)	Percentage of RfC
Formaldehyde	9.8	0.8	8.2 %

The EPA has classified formaldehyde as a probable human carcinogen of medium carcinogenic hazard with an inhalation unit risk factor of 1.3×10^{-5} $(\mu g/m^3)^{-1}$ (inverse micrograms per cubic meter) (EPA 1994).

Predicted formaldehyde concentrations were combined with traditional risk assessment methods to estimate the potential cancer risk from formaldehyde exposure (Table 4-5). Utilizing the predicted maximum formaldehyde concentration of 0.80 µg/m^3 and assuming a maximum exposure scenario of 24 hours per day for the expected life of the project (20 years), the incremental formaldehyde cancer risk is estimated at 2.9 per one million exposures. This estimated formaldehyde risk is slightly higher than the EPA significance criteria of 1.0 per million exposures. This method of analysis, however, is extremely conservative based on the assumption that persons would be exposed to the maximum model predicted concentration of formaldehyde for 24 hours per day over a 20 year period. Furthermore, the maximum predicted concentrations of formaldehyde were observed at locations very close to the proposed compressor stations and decreased rapidly with distance, indicating that an occupational exposure scenario would be most appropriate.

Using a more realistic occupational exposure scenario of eight hours exposure per day for the life of the Proposed Action, termed the most likely exposure or MLE, the incremental risk is estimated at 0.9 per million exposures, just under the EPA significance criteria of 1.0 per million exposures.

4.2.1.1.4 Air Quality Related Value Impacts

The latest version of the CALPUFF dispersion model was used, in the screening mode, to estimate the Proposed Action impacts on Air Quality Related Values (AQRVs) for selected areas of special concern. Five years of Rock Springs surface meteorological data (1985, 1987-1990) were applied in the analysis. Proposed Action sources included compressors, well pumps, wind erosion, drill rig, and vehicle dust and tailpipe emissions. Predicted results were evaluated against visibility, dry and wet deposition, and acid neutralization capacity (ANC) criteria for the areas of special concern listed in Table 4-6.

Table 4-5. Potential Incremental Carcinogenic Risk

Hazardous Air Pollutant	Incremental Carcinogenic Risk Resulting from the Maximum Exposure Scenario[1]	Incremental Carcinogenic Risk Resulting from the Most Likely Exposure Scenario[2]
Formaldehyde	2.9 in one million	0.9 in one million

Risk/Million:

$$= \frac{(CH_2O\ \mu g/m^3)*(\text{Expected Life of Proposed Action}/70\ \text{Year Life Span})*(CH_2O\ \text{Unit Risk Factor})}{1.0E\text{-}6}$$

$$= {}^{1}\frac{(0.8\ \mu g/m^3)*(0.286)*(1.3E\text{-}5)}{1.0E\text{-}6} = 2.8/\text{million}$$

$$= {}^{2}\frac{(0.8\ \mu g/m^3)*(0.286)*(8/24)*(1.3E\text{-}5)}{1.0E\text{-}6} = 0.9/\text{million}$$

Table 4-6. Areas of Special Concern

Special Concern Area	Managing Agency	Distance from Proposed Action (mi)	Direction from Proposed Action
Bridger Wilderness	USFS	93	NNW
Fitzpatrick Wilderness	USFS	140	NNW
Popo Agie Wilderness	USFS	93	NNW
Savage Run Wilderness	USFS	140	ESE
Wind River Roadless	USFS	120	NNW

Visibility Impacts

Visibility impairment was evaluated in terms of the change in deciview (Δ dv). The deciview index was developed as a linear perceived visual change. A change in visibility of 1.0 dv represents a "just noticeable change" by the average person under most circumstances. Increasing deciview values represent proportionately larger perceived visibility impairments. The Forest Service uses a 0.5 Δ dv as a level of acceptable change (LAC) threshold in order to protect visibility in sensitive areas. A 1.0 Δ dv threshold is used in the Regional Haze Regulations and has been used by other agencies as a management threshold. The 0.5 and 1.0 Δ dv thresholds are neither standards nor regulatory limits. Rather, they are used to alert the affected land managers that potential adverse visibility impacts may exist and the land manager may wish to look at the magnitude, duration, frequency, and source of the impacts in more detail in order to make a significance determination.

For the Proposed Action, a screening level analysis for visibility was conducted following the recommendations in the FLAG (2000) Guideline document. The potential sources of visibility impairment resulting from the Proposed Action are primary PM_{10} and secondary nitrate particulate matter. Potential 24-hour concentrations for these pollutants were modeled for the special concern areas. These values were then applied in a comparison to background conditions (using monthly site-specific *f(RH)* relative humidity adjustments; EPA 2001) by calculating a potential change in deciview. Background seasonal extinction values from the FLAG (2000) Phase I Report were applied for all areas of special concern listed in Table 4.2-6. When not available for the specified area, background data from nearby areas were substituted. For the Savage Run Wilderness, background data from nearby Rawah Wilderness was applied. Similarly, background values from the Bridger and Fitzpatrick Wilderness Areas were substituted for the Popo Agie Wilderness and Wind River Roadless Areas, respectively.

For the Proposed Action alone, no impacts greater than the 0.5 or 1.0 Δ dv LAC thresholds were predicted. The maximum predicted impact was 0.4 Δ dv occurring at Popo Agie Wilderness. Table 4-7 lists the predicted maximum impacts for each special concern area.

Table 4-7. Predicted Visibility Impacts From the Proposed Action

Special Concern Area	Maximum Visibility Impact (Δ dv)	Visibility Significance Criteria (Δ dv)	Number of Days Greater than 0.5 Δ dv	Number of Days Greater than 1.0 Δ dv
Bridger Wilderness	0.4	0.5 / 1.0	0	0
Fitzpatrick Wilderness	0.4	0.5 / 1.0	0	0
Popo Agie Wilderness	0.4	0.5 / 1.0	0	0
Savage Run Wilderness	0.3	0.5 / 1.0	0	0
Wind River Roadless	0.4	0.5 / 1.0	0	0

Dry and Wet Deposition Impacts

Dry deposition fluxes were predicted for gaseous NO_x and nitric acid (HNO_3), as well as particulate nitrate (NO_3^-). Wet deposition fluxes were predicted for NO_3^-. Results are reported in total (wet + dry) nitrogen (N) deposition. Since the Proposed Action is not anticipated to be a substantial source for sulfur based chemical species, the calculation of sulfur deposition fluxes was not warranted.

Predicted total nitrogen deposition was compared to the USDA-Forest Service threshold value of 3 kg ha^{-1} yr^{-1}. (Fox et al 1989). Table 4-8 indicates that Proposed Action impacts on total nitrogen deposition are predicted to be below this threshold value for all areas of special concern.

Table 4-8. Proposed Action Impact on Total Nitrogen Deposition

Special Concern Area	Maximum Nitrogen Deposition (kg ha^{-1} yr^{-1})	Nitrogen Deposition Significance Criteria (kg ha^{-1} yr^{-1})	Maximum Percent of Threshold
Bridger Wilderness	2.46 E-03	3.0	0.08%
Fitzpatrick Wilderness	1.40 E-03	3.0	0.05%
Popo Agie Wilderness	2.54 E-03	3.0	0.08%
Savage Run Wilderness	1.30 E-03	3.0	0.04%
Wind River Roadless	1.62 E-03	3.0	0.05%

Acid Neutralization Capacity Impacts

An analysis of potential changes to Acid Neutralization Capacity (ANC) was performed for each of six sensitive lakes (Table 4-9) using the procedure recommended by the USDA – Forest Service (2000). This procedure incorporates predicted deposition results in a comparison to background ANC values for the lakes of concern. Calculated Proposed Action impacts were compared to a 10 percent change in ANC for lakes with background ANC values equal to, or above, 25 microequivalents per liter (µeq/l). For Upper Frozen Lake with a background ANC value of less than 25 µeq/l, the results were compared to a threshold of no more than one µeq/l total change in ANC. The results indicate that potential changes in lake ANC due to Proposed Action impacts alone are expected to be well below established LAC threshold values.

4.2.1.2 No Action Alternative

4.2.1.2.1 Air Quality Impacts

Impacts to air quality under the No Action Alternative would occur at levels similar in nature to, but on a smaller scale than, those described under the Proposed Action. Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas

Conservation Commission approval. No substantial air quality impacts are anticipated under this alternative.

Table 4-9. Proposed Action Impact on Acid Neutralization Capacity

Lake Name	Special Concern Area	Background ANC Concentration [a] (µeq/l)	Level of Acceptable Change	Proposed Action Change in ANC
Black Joe	Bridger Wilderness	69.0	10%	0.03%
Deep	Bridger Wilderness	61.0	10%	0.04%
Hobbs	Bridger Wilderness	68.0	10%	0.02%
Upper Frozen	Bridger Wilderness	5.8	1 µeq/l	0.02 µeq/l
Ross	Fitzpatrick Wilderness	61.4	10%	0.01%
Lower Saddlebag	Popo Agie Wilderness	55.5	10%	0.04%

[a] Data collected as part of the Draft Environmental Impact Statement for the Powder River Basin Oil and Gas Project (Bureau of Land Management 2002).

Air Quality Impacts Summary

No substantial adverse impacts to air quality are anticipated as a result of the Proposed Action and the No Action Alternative. Localized increases in NO_x, CO, and PM_{10} concentrations would occur under both Actions, but maximum concentrations would be below applicable Federal and State standards. Hazardous air pollutant health risks and incremental increases in cancer risk would be below applicable significance levels. Potential impacts to visibility, acid neutralization capacity, and total nitrogen deposition would be below the levels of acceptable change.

4.2.3 Mitigation Summary

Potential air quality impacts resulting from the Proposed Action could be reduced through the implementation of engineering control or other measures.

NO_x Mitigation

The primary sources of NO_x emissions associated with the Proposed Action are the natural gas-fueled compressor engines and well pump sources. The following potential mitigation measures could reduce impacts from NO_x emissions. The appropriate level of control will be determined and required by the WDEQ-AQD during the pre-construction permit process.

- In the permitting of compressor engines, the WDEQ-AQD always requires application of the Best Available Control Technology (BACT) process. As a result of the BACT process, emissions rates for compressor engines 100 hp and greater average 1.0 g/hp-hr NO_x. With the application of non-selective catalytic reduction, NO_x emissions for some compressor engines can be reduced to 0.7 g/hp-hr.

- Compressors and well pump sources powered by electric motors could reduce NO_x emissions within the immediate project area. However, increased NO_x emissions are likely to result at the point of electrical generation.
- Proposed Action related NO_x emissions could be offset through the application of controls at non-project sources.

Particulate Matter Mitigation

The primary Proposed Action related sources of particulate matter result from vehicle travel on unpaved roads and wind erosion. The following mitigation measures could reduce project related impacts from particulate emissions:

- Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced to reduce the amount of fugitive dust generated by vehicle traffic.
- Water or other dust suppressants could be applied as necessary on unpaved roads and construction areas to reduce problem fugitive dust emissions.
- Operators could establish and enforce speed limits on all project related unpaved roads to reduce vehicle fugitive dust.

4.2.4 Residual Impacts

Implementation of the Proposed Action would result in minor increases in air pollutant emissions throughout the life of the project. As previously discussed, however, the increased pollutant concentrations resulting from the Proposed Action are not anticipated to exceed national standards (NAAQS) or PSD increments. Similarly, the Proposed Action is not likely to impact AQRVs such as visibility, acid neutralization capacity, or total nitrogen deposition at levels above the respective LACs.

4.3 SOILS

4.3.1 Impacts

4.3.1.1 Proposed Action

Impacts could occur to the soil environment as a result of the Proposed Action if during surface alteration land surfaces and gradients are steepen, which could increase runoff and erosion, or if soil cover is removed and the area is subject to accelerated erosion, undercutting, collapse or subsidence. The soils although clay-rich contain a mixture of eolian sand and are generally moderate to well drained. The underlying formations, particularly the Wasatch Formation, have a high clay content and areas where soil cover has been removed may become problematic or impassible immediately after heavy precipitation due to swelling clays.

4.3.1.2 No Action Alternative

Under this alternative, additional gas development could occur through the approval of individual wells on Federal lands. Development on State and private lands would continue though Wyoming Oil and Gas Conservation Commission approval. Impacts to the soils of the project area would be similar to those described under the Proposed Action, but to a lesser extent. The soils in the area are generally moderate to well-drained and with the exception of

the eastern part of the area; the natural slope of the lands and underlying geologic dip is low thereby lessening the chance of flooding, erosion, or collapse or subsidence.

4.3.2 Mitigation

No additional mitigation to the soil environment is proposed.

4.3.3 Residual Impacts

No residual impacts to soils are identified.

4.4 WATER RESOURCES

4.4.1 Impacts

4.4.1.1 Proposed Action

4.4.1.1.1 Surface Water

Potential impacts that could occur to the surface water system due to the Proposed Action include increased surface water runoff and off-site sedimentation due to soil disturbance (Soils Section 4.3), water quality impairment of surface waters, and stream channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration of construction activities, and the timely implementation and success/failure of mitigation measures. Impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to stabilization, reclamation, and revegetation efforts. Construction activities would occur over a relatively short period of time; therefore, the majority of the disturbance would be intense but short-lived. Petroleum products and other chemicals could be accidentally spilled resulting in surface water contamination. Similarly, reserve and evaporative pits could leak if liners were punctured or no liners were installed, resulting in surface and subsurface water degradation.

The primary impact of the Proposed Action on surface water resources is the potential for increasing surface runoff, erosion, and off-site sedimentation that could cause channel instability and degradation of surface water quality. As described in Chapter 2, total new short-term surface disturbance resulting from the Proposed Action would be 583 acres (approximately 0.2 percent of the total CRPA which encompasses about 24,953 acres). This total would include 178 acres of new surface disturbance from well locations (including on-site gathering, measurement, and compressor facilities), 162 acres of new roads or upgrades of existing roads, and 243 acres of new pipeline construction. The construction disturbance would not be uniformly distributed across the project area, but rather, project facilities would be located where the efficiency and feasibility of extracting the natural gas would be the highest as discussed in Chapter 2. Locating of project facilities on slopes in excess of 25 percent would be avoided.

The primary roads utilized to access the CRPA are U.S. Highway 430, Sweetwater County Roads No. 4024 and 4-26, and existing lease roads (Figures 3-14 and 3-15). The Proposed Action area would encompass two existing oil and associated gas facilities and infrastructure currently accessed by an existing road network. The existing road network was developed to access prior

and ongoing drilling and production activities, as well as other land use activities on Federal surface. All new access roads would be constructed specifically for shallow gas field development. The Proposed Action assumes the construction of no more than 89 wells and associated roads and pipelines. Roads would be designed to minimize disturbance, and all surface disturbance would be contained within the road ROW. In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities. Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed. The CRPA would have a maximum of 22.25 miles (81 acres) of new roads or upgrades of existing roads and 66.75 miles (242.7 acres) of new gas and water collection lines would be installed in a 30-foot wide facilities corridor. An average of 0.75 miles of new gas gathering and water discharge lines per well would be installed, of which approximately 0.5 miles would be constructed within existing pipeline corridors.

The majority of soil disturbance would be well away from stream channels as required by GRMP management directives identified in Section 4.4.2 (within 500 feet of live streams, lakes, reservoirs, canals and associated riparian habitat, and water wells; within 660 feet of springs or flowing artesian wells; and within 200 feet of intermittent and ephemeral streams). Authorization of the Proposed Action would require full compliance with the RMP management directives that relate to surface water protection, Executive Order 11990 (floodplains protection), and the CWA in regard to protection of water quality and compliance with Section 404 permits. These directives require avoidance of stream channels to the maximum extent possible. Where total avoidance is not possible, the minimization of impacts to streams and associated floodplains/floodways must be implemented and the operator would be required to show the BLM AO why such resources cannot be avoided and how impacts would be minimized. These regulations also require that certain permits/authorizations be obtained for project implementation including a NPDES permit (needed for surface discharge); development of a surface runoff, erosion, and sedimentation control plan; oil spill containment and contingency plan; as well as CWA Section 404 permits. Given these conditions, adverse sedimentation is not expected to occur as a result of the implementation of the Proposed Action.

Most of the ephemeral and intermittent drainage channels identified on Figure 3-3 are classified as waters of the U.S. Crossings of these channels and any associated wetlands would require authorization from the COE through the CWA Section 404 permitting process. However, these channel crossings would likely receive expedited authorization from the COE through Nationwide Permits No. 12 (buried utility lines) and/or No. 14 (minor road crossing fills) and No. 18 (minor discharges) as well as Programmatic General Permit 98-08. Other project facilities could not be located in waters of the U.S., and therefore, Section 404 permitting would not be necessary for such facilities. Each individual channel crossing would be reviewed during the APD/ROW permitting process for specific permit requirements under Section 404 and the CWA. Given these conditions, wetland damage is not expected to occur as a result of the implementation of the Proposed Action.

There is a remote chance that road and pipeline construction across established channels could adversely modify flow hydraulics. However, with correct design of channel crossings, including design for 25- to 50-year runoff events, no adverse impacts are expected. As discussed in Chapter 3, drainage channels in the project area are predominantly ephemeral to intermittent. Therefore, it is unlikely that increased sedimentation would adversely affect water quality of surface waters.

Reserve pits would be utilized to contain drilling fluids, cuttings, and water produced during drilling. The reserve pit would be lined as needed with an impermeable liner to prevent seepage. Bentonite or synthetic lining would be used where appropriate as defined during the APD review. The synthetic liner would be at least 12 mils thick, reinforced with a bursting strength of 174 x 175 pounds per inch (ASTMD 75719), resistant to decay from sunlight and hydrocarbons, and compatible with the drilling fluids to be retained. Leakage of the pit fluids would be minimal from lined reserve pits unless the liners were installed incorrectly or the liners were damaged during drilling operations. Thus, adverse impacts from leaks in lined reserve pits would likely not occur.

Water would be obtained from the water supply wells located in Section 10, T16N, R101W. The project would require approximately 252,000 gallons of water per well, assuming no re-use of drilling water, for completion, well stimulation and dust control. This water demand is relatively small and would not adversely affect existing surface or groundwater sources or rights.

Methods used for the disposal of produced water (water produced in association with the shallow gas which is separated out at the well location) would vary but would generally be accomplished by either disposal in an underground injection well or surface evaporation in lined or unlined ponds. The operator would obtain the permit(s) necessary for the selected disposal method. Depending on timing of availability, quantity, and quality of produced water; some of the produced water could be used in well drilling and completion, and pipeline construction and hydrostatic testing.

Handling and management of hydrostatic test water, if used by the operator, would be accomplished in a manner that does not adversely affect soils, stream channels, and surface water and groundwater quality. After testing operations are completed, the water would be pumped into water hauling trucks and transported to drilling locations within the project area and used in conjunction with the drilling operations. However, if such water is not re-used it would be disposed of in a manner where soil scouring and water quality impairment would not result. Hydrostatic test water would be evaluated for compliance with State water quality standards. No test water would be discharged unless such water meets these standards. Test water not needed for drilling operations that meets water quality standards would be disposed of onto undisturbed land having vegetative cover or into an established drainage channel in a manner as not to cause accelerated erosion.

If a well is productive, site erosion and off-site sedimentation would be controlled by promptly revegetating sites in the first appropriate season (fall or spring) after drilling, and providing surface water drainage controls, such as berms, sediment collection traps, diversion ditches, and erosion stops as needed. These measures would be described in the individual APD/ROW.

4.4.1.1.2 Groundwater

The primary impact of the Proposed Action on groundwater resources is best described as the loss of hydraulic pressure head in the affected coal seam aquifer. The removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head, thus lowering the water levels in nearby wells completed in the same coal seam. The lowering of water levels in an aquifer is also referred to as drawdown.

A description of the geology and hydrology of the Copper Ridge Shallow Gas Project is given in Chapter 3. The focus of this groundwater impact assessment is the coal seam aquifers within the

Almond Formation, a member of the Upper Cretaceous Mesaverde Group. These targeted coal seams are classified as confined to semi-confined aquifers because they are bound by aquitards consisting of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the Almond Formation coal seams and any aquifer stratigraphically above or below the coal seams is therefore very limited. The hydrostatic pressure head of the water measured in coal seam test wells completed in the project area can be considerably higher than the aquifer elevation at any respective well location. Confined, or artesian, aquifer conditions of this type are indicative of an effective seal or aquitard above and below the aquifer. However, lowering of the hydraulic pressure head in the coal seam aquifer by dewatering activities may induce a slight leakage of water through the semi-pervious shale layers into the pumped aquifer. Due to extremely low hydraulic conductivity of the confining layers, enhanced leakage from any aquifer stratigraphically above or below the dewatered coal seams would be minimal, and only after a period of time would drawdown effects in any overlying aquifer become apparent.

Currently, the lack of site-specific data within the project area does not justify the use of a three dimensional groundwater drawdown model, such as the U.S. Geological Survey's Three Dimensional Finite Difference Modular Groundwater Flow Model, MODFLOW (McDonald & Harbaugh, 1988) to predict drawdown impacts. The data necessary for a model of this type includes elevations, hydraulic conductivities and potentiometric surfaces for the coal seam(s) and confining layers. Until additional drilling and testing are conducted and data of these types are collected, the use of a simpler planning-level model is justified. Therefore, the aerial extent of drawdown within the coal aquifer due to the removal of water for the shallow gas project was estimated using an aquifer analysis model that is based on equations describing transient flow to pumping wells developed by Theis (1935). This model provides a conservative prediction of look at potential drawdown resulting from groundwater pumpage at a well or group of wells. The assumptions used with this model are that the aquifer is isotropic (aquifer properties do not vary with direction), homogeneous (aquifer properties do not vary with location), of infinite aerial extent, and lies horizontally. Obviously, these simplifying assumptions are not met by the Almond Formation coal seams. Use of these simplifying assumptions is likely to result in a conservative analysis, with drawdowns overstated as compared to what are likely to occur. As described below, the aquifer's hydraulic and physical parameters used in the model were derived from both the literature and from actual field measurements.

It was further assumed that the aquifer is confined (a storage coefficient of 0.0002 was used) and that the confining layers are leaky. The available head, which is the height to which water would rise measured from the bottom of the aquifer, was estimated using the hydrostatic pressure heads gauged in existing shallow gas wells.

Long-term, steady state shallow gas well water production data within the Proposed Action area is presently unavailable. Short-term tests on recently completed shallow gas wells indicate that discharge rates are highly variable. An anticipated steady-state discharge rate of seven gallons per minute (gpm) was assigned to each of the 89 shallow gas well locations to simulate the Proposed Action. The locations of these 89 pumping wells were distributed in the locations proposed in the Copper Ridge Unit Field Map. The model simulated these 89 wells pumping continuously for a period of 10, 20, and 30 years. The resulting average extent of drawdown was then contoured, as shown in Figure 4-1. In reality, discharge rates may exceed this amount at the onset of production but would decline over time, likely reaching zero in the later stages of the project. This is because as the formation pressures drop, the gas would begin to flow more freely into the well and much less water would need to be produced.

This model predicts that, after 30 years the 10-foot drawdown contour in the coal would extend approximately 14 miles north, 14 miles west, and 12 miles south of the Copper Ridge shallow gas project area. Ten feet of drawdown represents less than one percent of the estimated available head in this area. Water levels are predicted to decline as much as 2,000 feet at Black Butte Creek within the CRPA (Figure 4-1).

Due to the approximate nature of the Theis aquifer model, drawdowns predicted between the CRPA and the coal seam outcrop, are simplified. The total available drawdown between the project area and the coal outcrop/subcrop trace is unknown, and it is conservatively assumed that the affected coal seam would be completely dewatered in these areas. Again, in light of the available data the Theis model was considered to be the best representation of the dewatering stresses imposed by the proposed shallow gas project. With more data available in the future, a numerical model (e.g., MODFLOW) may be applied.

The reduction of hydraulic pressure head in the affected coal seam aquifer would mean that any well completed in the same coal seam within the area of influence may be impacted. As described in Chapter 3, there are currently no active permitted water wells located within the CRPA. There are five permitted water wells located within the projected 10-foot drawdown area; however, the well completion information from the SEO records is too vague to determine whether or not an Almond coal seam is the contributing aquifer. Nevertheless, the wells are located such that if they are completed within an affected coal seam, the probability is high that they would be impacted.

No springs or seeps have been identified within the project area. If any should be discovered during the life of the project, the exact locations and associated water-bearing strata of such surface expressions of groundwater would be evaluated during the site-specific analysis conducted for all components at the APD stage. Due to coal seam depths in the CRPA, it is unlikely that drawdown in the coal seam would adversely affect springs or seeps in the project area if any were to be located. Further, all construction activities and storage of petroleum products would be kept away from any seeps and springs (a minimum distance of 200 to 600 feet depending on the type of spring); therefore, contamination would be unlikely.

In addition to drawdown in the affected coal seam aquifer, the geologic unit(s) chosen for the subsurface disposal of shallow gas produced water would also be affected. At this time, little data are available to describe the geologic unit(s) that would be the injection target. Data would be collected on potential host units during the drilling and completion of the shallow gas wells and the new disposal/injection wells, if needed. Information from the these sources would allow the operator to more accurately predict shallow gas water production data and the depths, hydrostatic pressures, permeabilities, and other technical information necessary to assess impacts to subsurface geologic units chosen as injection zones. In general, the principle impact resulting from subsurface water disposal would consist of an increase in hydrostatic pressure in the geologic unit(s) chosen as the injection zone. It is unlikely that the water quality of the native groundwater in the host aquifer(s) would be degraded because the produced water would be of equal or higher quality than that of the injection zone. The produced water would be gathered from aquifers that occur at shallow depths in relatively close proximity to recharge areas, where

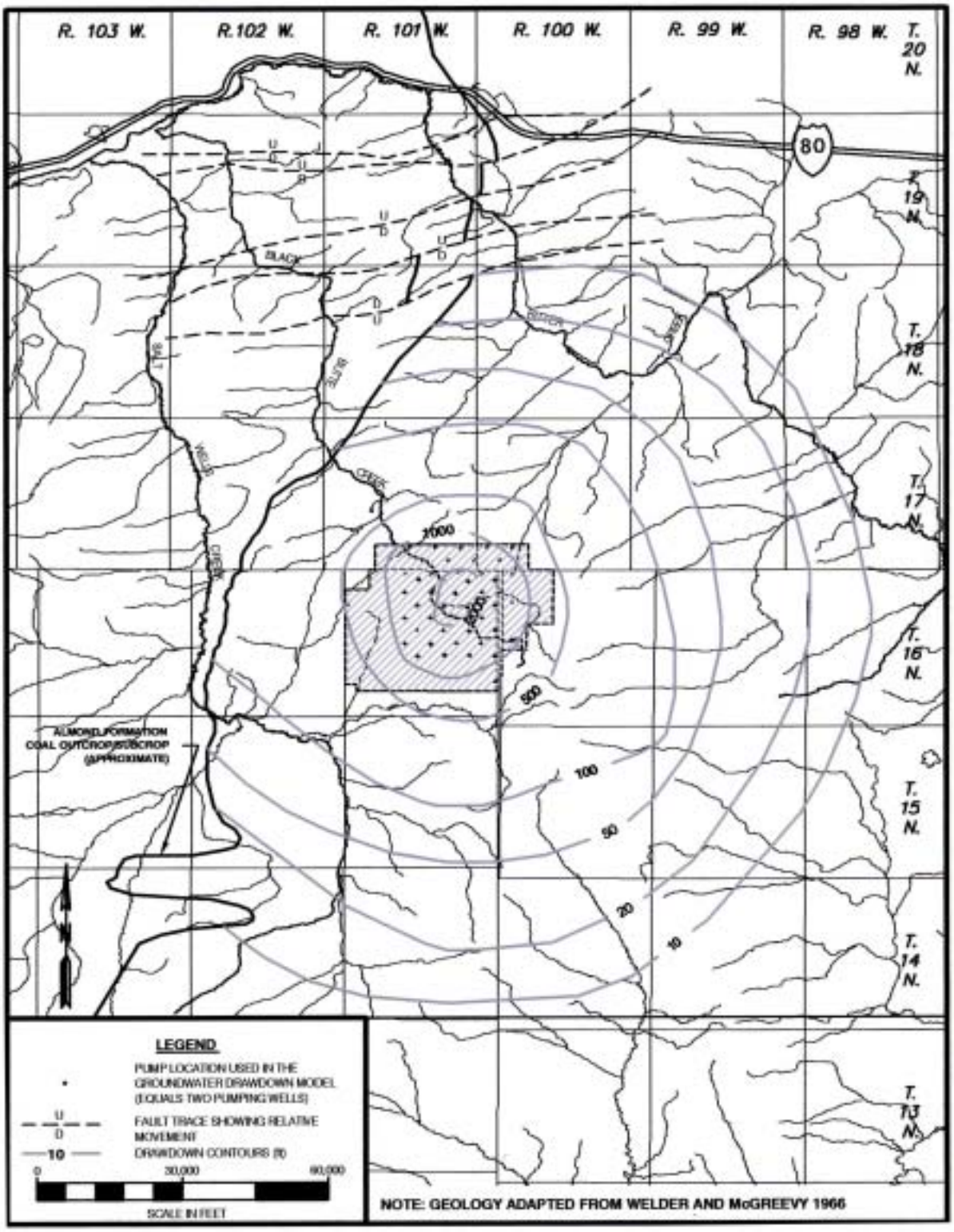


Figure 4-1. Modeled Maximum Extent of Drawdown Within the Almond Formation Coal Aquifer Due to the Proposed Action.

groundwater would be fresher and have smaller concentrations of dissolved solids relative to that of aquifer occurring at greater depth that would be targeted for disposal.

Groundwater from the deeper host aquifer(s) is further from recharge areas and as a result of increased contact time with the host rock would have higher dissolved solids concentrations than groundwater occurring in shallower aquifer units.

In the event that an injection well ceases to operate properly due to formation over-pressuring or mechanical failure, the operator must still remain in compliance with all applicable regulations governing the operation of the produced water disposal system. Compliance options available to the operator include curtailing or halting the rate of water production or routing the discharge to additional injection wells.

Well drilling and completion should not have an adverse effect on groundwater quality. Poor drilling and completion techniques could result in degradation of groundwater due to the mixing of variable quality waters from different water-bearing strata that happen to be pierced by the borehole. The magnitude of mixing, if any, which would occur during the relatively short period of time during drilling, should be relatively small. In addition, due to the state-of-the-art drilling and well completion techniques, the possibility of serious degradation of groundwater quality by the Proposed Action would be very low. The improbable degradation of groundwater quality within any aquifers in the project area essentially eliminates the possibility of adverse effects to the identified water rights holders (Chapter 3).

4.4.1.2 No Action Alternative

Impacts to water resources with implementation of No Action would be similar to the Proposed Action but of a lesser magnitude.

4.4.2 Mitigation

The following measure would further reduce potential impacts.

Should existing water wells be adversely affected by the project, the company should rework, replace, or otherwise compensate the well owner.

4.4.3 Residual Impacts

No residual impacts would result from project implementation.

4.5 VEGETATION, WETLANDS AND NOXIOUS WEEDS

4.5.1 Impacts

4.5.1.1 Proposed Action

Potential impacts to existing native shrub/grassland communities resulting from project implementation may include direct impacts such as disturbance, reduction, and/or removal of vegetation. Potential indirect impacts to the vegetation resource may occur as a result of soil compaction, mixing of soil horizons, loss of topsoil productivity, increased soil surface exposure,

soil loss due to wind and water erosion, and damage to biological soil crusts (Belnap et al. 2001). .

The proposed action assumes construction of 89 wells and associated roads and pipelines. Construction and installation of well sites, access roads, and ancillary facilities (including pipelines) would directly reduce the extent of vegetation cover types. Over the estimated 2-4 year development phase, the Proposed Action would involve surface disturbance of about 502 acres (2.6% of the CRPA). This disturbance would be distributed among the primary and secondary vegetation types on the CRPA identified by the Wyoming GAP Analysis (Merrill et al. 1996). For purposes of this analysis it was assumed that disturbance associated with access roads and pipelines would be located in the same vegetation cover type as the proposed well location.

Analysis of initial construction disturbance upon vegetation cover types is based on the approximate location of proposed wells prior to construction; actual placement of wells may change as development proceeds. As shown in Table 4-10, of the 89 proposed wells, 86 would be located in the Wyoming big sagebrush primary cover type with a total disturbance of 485.1 acres or 2.0 percent of this cover type. Three wells would be located in the desert shrub primary vegetation cover type with a total disturbance of 16.9 acres or about 2.6 percent of this primary cover type.

Fifty-four wells would be located in the mixed grass prairie secondary cover type with a total disturbance of 304.5 acres or about 1.7 percent of this secondary cover type. Three wells would be located in the Wyoming big sagebrush secondary cover type with a total disturbance of about 16.9 acres which represents about 2.6 percent of this secondary cover type. Thirty-two wells would be located in the desert shrub secondary cover type which represents about 2.9 percent of this secondary cover type.

During the production phase of the project, pipelines and about one acre of each initial two acre well pad area would be reclaimed. Therefore, total vegetation disturbance would be reduced from an initial 502 acres to about 170.8 acres after successful reclamation and during the LOP.

In general, the extent of these impacts would be influenced by success of mitigation and reclamation efforts and the time period required for disturbed areas to return to pre-existing conditions. Reclamation success, in part, depends on the amount of surface area disturbed and quality of topsoil salvaged and stockpile/redistribution methods in disturbed areas, precipitation, soil type, and moisture availability. Reseeding and reclamation efforts could proceed after cessation of surface-disturbing activities and original contour and grade are achieved as discussed in Section 2.1.10.

Except for riparian/wetland and plant species of concern sites, disturbance of the upland Wyoming big sagebrush/mixed grass prairie vegetation type would be minor because of its abundance and wide area of distribution in this area of southwestern Wyoming. Despite the difficulty of establishing vegetation in upland Wyoming big sagebrush/grassland sites with <10 inches average annual precipitation, current technology exists to stabilize these areas and minimize soil erosion as natural succession returns the site to pre-existing conditions. Any potential impacts would be minimized assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance with Chapter 2 of this EA, Anadarko's APDs, and RMP requirements.

Table 4-10. Summary of Potential Vegetation Impacts (acres) with Implementation of the Proposed Action.*

Vegetation Cover Type[A]	Area[A]	Well Pads #	Well Pads ac[B]	Roads (ac)[C]	Pipeline (ac)[D]	Total Acres	%[E]
PRIMARY COVER							
Wyoming big sagebrush	24304.2	86	172.0	78.3	234.8	485.1	2.0
Desert shrub	648.8	3	6.0	2.7	8.2	16.9	2.6
Total	24953.0 (24782.2)[F]	89 (89)	178.0 (89.0)	81.0 (81.0)	66.8 (0.0)	502.0 (170.8)	2.0 (0.7)
SECONDARY COVER							
Mixed grass prairie	18041.0	54	108.0	49.1	147.4	304.5	1.7
Wyoming big sagebrush	648.8	3	6.0	2.7	8.2	16.9	2.6
Desert shrub	6263.2	32	64.0	29.1	87.4	180.5	2.9
Total	24953.0 (24782.2)	89 (89)	178.0 (89.0)	81.0 (81.0)	243.0 (0.0)	502.0 (170.8)	2.0 (0.7)

***NOTE:** Averages may differ slightly from those shown in Table 2-1 due to rounding differences, use of significant numbers, and the exclusion of the compressor site (0.9 acres) which would be located on private land.
[A] Merrill et al. (1986).
[B] Assumes an initial disturbance of about 2.0 acres per well pad and LOP disturbance of one acre per well pad.
[C] Assumes an average of 0.25 mi of new road with parallel gas gathering and water discharge lines (60 foot avg. disturbance width) per well. All disturbance except for the estimated 30 foot wide road and adjacent ditches would be reclaimed during the LOP.
[D] Assumes and average of 0.75 mile (avg. disturbance width of 30 feet) of new gas gathering and water discharge lines per well, of which about 0.50 mile would be constructed using existing pipeline corridors.
[E] Percentage of each vegetation type disturbed.
[F] Estimated life-of-project (LOP) total disturbances are enclosed in parenthesis, based upon assumptions stated above ([B, C,] and [D]).

Wetlands

Due to a paucity of wetland/riparian sites on the CRPA, the probability of well pads, roads, or pipelines impacting these resources is low. The RMP specifies that a 500 foot (minimum) buffer around riparian and other water resources would be maintained. Permits under Section 404 of the Clean Water Act would be required for any activities in wetlands. Anadarko would be required to demonstrate to the Army Corps of Engineers (COE) that there are no "practical alternatives" to placement of a well location in a wetland. The probability of impacting wetlands and other waters of the U.S. under the Proposed Action is low given the xeric nature of the CRPA and identified mitigation procedures stated in Chapter 2, Anadarko's APD's, the RMP, COE and BLM surface- disturbing guidelines.

Noxious Plant Species

Surface disturbing activities could increase the potential for infestation and spread of invasive (includes noxious) plant species. Invasive species, especially weeds, usually thrive on newly disturbed surfaces such as road and pipeline ROW's and out-compete more desirable plant

species. As explained in Section 2.2.2.12.13, Anadarko would be responsible for the management and control of all invasive (including noxious) weed species infestations on project-related surface disturbances during the projected LOP and would consult with the BLM Authorizing Officer (AO) and/or local Sweetwater County Weed and Pest Control District authority for acceptable weed control methods.

Appendix 9-2 of the RMP provides guidelines for herbicide utilization within the RSFO management area. In addition, Appendix 5-1 of the RMP specifies that herbicide loading sites would be located at least 500 feet from live water, floodplains, riparian areas, and all special status plant locations. In addition, aerial spraying of chemicals would be prohibited within 1/4 mile of special plant locations, and hand application would be prohibited within 500 feet. Control measures would adhere to those allowed in the *FEIS, Vegetation treatment on BLM lands in the thirteen western states* (USDI-BLM 1991).

4.5.1.2 Alternative A - No Action

Under the No Action Alternative, direct and indirect vegetation impacts would continue as additional individual exploratory and development activities beyond this EA are considered by the BLM on a case-by-case basis for individual APDs on federal lands. Additional gas development would occur on State and private lands within the CRPA under APDs approved by the WOGCC. Transport of natural gas products would be allowed from those wells in the CRPA that are in current production. Table 4-11 summarizes potential impacts under the No Action alternative.

The No Action alternative assumes construction of 48 wells and associated roads and pipelines. Construction and installation of well sites, access roads, and ancillary facilities (including pipelines) would directly reduce the extent of vegetation cover types. Over the estimated 2-4 year development phase of the project, the No Action alternative would involve a total initial disturbance of about 337 acres (Table 4-11) or about 1.4% of the CRPA's total land surface. Through successful reclamation of pipeline ROW's and about 1 acre per well pad, the total disturbed acres over the LOP would be reduced to about 92 acres.

As shown in Table 4-11, of these 48 proposed wells, 47 would be located in the Wyoming big sagebrush primary cover type with a total disturbance of 331.3 acres or 1.4% of this primary cover type. One well would be located in the desert shrub primary cover type with a total initial disturbance of 5.6 acres or about 0.9% of this primary cover type.

Twenty-one wells would be located in the mixed grass prairie secondary cover type with a total initial disturbance of 118.4 aces or about 0.7% of this secondary cover type. One well would be located in the Wyoming big sagebrush secondary cover type with a total initial disturbance of 5.6 acres or about 0.9% of this secondary cover type. Twenty-six wells would be located in the desert shrub secondary cover type with a total initial disturbance of 146.7 acres or about 2.3% of this secondary cover type.

Potential impacts to wetlands and waters of the U.S., federally listed plant species, BLM plant species of concern, and invasive plants would remain unchanged from those of the Proposed Action. However, federal disturbed acres under the No Action alternative would be reduced about 72% from an initial 231 acres of the Proposed Action to 65 acres under the No Action alternative. During the LOP, these 65 acres are estimated to stabilize at about 16.4 acres, assuming a successful reseeding and reclamation program.

Table 4–11. Summary of Potential Vegetation Impacts (acres) under the No Action Alternative.

Vegetation Cover Type[A]	Area (ac)[A]	Well Pads #	Well Pads ac[B]	Roads (ac)[C]	Pipeline (ac)[D]	Total Acres	%[E]
PRIMARY COVER							
Wyoming big sagebrush	24304.2	47	94.0	59.9	177.4	331.3	1.4
Desert shrub	648.8	1	2.0	0.9	2.7	5.6	0.9
Total	24953.0 (24861.1)[F]	48 (48)	96.0 (48)	60.8[G] (43.7)	180.1[G] (0.0)	336.9[G] (91.7)	1.4 (0.4)
SECONDARY COVER							
Mixed grass prairie	18041.0	21	42.0	19.1	57.3	118.4	0.7
Wyoming big sagebrush	648.8	1	2.0	0.9	2.7	5.6	0.9
Desert shrub	6263.2	26	52.0	23.7	71.0	146.7	2.3
Total	24953.0 (24861.3)	48 (48)	96.0 (48)	60.8[G] (43.7)	180.1[G] (0.0)	336.9[G] (91.7)	1.1 (0.4)

***NOTE:** Averages may differ slightly from those shown in Table 2-1 due to rounding differences, use of significant numbers, and the exclusion of the compressor site (0.9 ac).
[A] Merrill et al. (1986).
[B] Assumes an initial disturbance of about 2.0 acres per well pad and LOP disturbance of one acre per well pad.
[C] Assumes and average of 0.25 mile of new road with parallel gas gathering and water discharge lines (60 foot avg. disturbance width) per well. All disturbances except the estimated 30 foot wide road and adjacent ditches would be reclaimed during the LOP.
[D] Assumes an average of 0.75 mile (30 ft. avg. disturbance width) of new gas gathering and water discharge lines per well, of which, about 05 mile would be constructed using existing pipeline corridors.
[E] Percentage of each vegetation type disturbed.
[F] Estimated LOP total disturbance enclosed in parenthesis, based upon assumptions stated in [B, C, and D.]
[G] Totals reflect disturbed state and private acres and includes about 65.4 federal acres disturbed by roads (16.4 ac) and pipelines (49.1 ac).

4.5.2 Mitigation

No additional mitigation would be required.

4.5.3 Residual Impacts

No residual impacts to the vegetation resource would take place with implementation of and compliance with mitigation measures and stipulations stated in Chapter 2 of this EA, Anadarko's APDs, and the RMP, realizing that full reclamation to pre-existing vegetation conditions (especially the shrub component) may require several decades in the arid environment of the project area, dependant in great part, to future climatic conditions and land-use patterns.

4.6 RANGE RESOURCES

4.6.1 Impacts

4.6.1.1 Proposed Action

Under the Proposed Action, an estimated 503 total (federal, state, private) acres would initially be disturbed which represents about 0.03% of the total land area (1,913,364 acres) of the Rock Springs grazing allotment. During the LOP, this total is estimated to decrease to about 171 acres which represents about 0.009% of the total land area of the allotment.

Sheep and cattle grazing would continue throughout the duration of the project. The primary impact to grazing resources would be short-term loss of available forage as a result of construction and production-related disturbance. Table 4-12 summarizes and compares, both for the Proposed Action and the No Action Alternative, the estimated initial disturbed acres with those during the LOP and corresponding AUM impacts.

Assuming all 89 wells are successful, the Proposed Action would result in an estimated initial 503.0 acres of short-term disturbance (about 2.0% of the total project area) or about 0.03% of the 1,913,364 acres encompassed within the Rock Springs grazing allotment (Lloyd 2003). During the anticipated LOP, this total is estimated to decrease to about 170.8 acres (0.7% of the total project area) or about 0.009% of the total land area of the grazing allotment.

The average stocking rate for the Rock Springs grazing allotment is about 14 acres per AUM (Lloyd 2003). Consequently, the Proposed Action would result in a short-term loss of about 35.9 AUMs, and a long-term loss of about 12.2 AUMs. These losses would amount to substantially less than one percent of the permitted 180,234 AUM's for the Rock Springs allotment (Lloyd 2003). Depending upon the success of drilling productive wells, long-term reduction of AUMs could be less than currently calculated. For example, in the existing Brady and Jackknife Spring Field's, 8 out of 59 wells drilled (14%) since 1972 were dry holes, and have been subsequently plugged, abandoned, and reclaimed. If 14% of the proposed new 89 wells are non-producing, an additional 12-13 well pads with their associated facilities and access roads would be reclaimed earlier in the LOP process resulting in increased available forage in a shorter time span than currently projected.

Under the Proposed Action, the estimated initial and LOP disturbed acres and associated AUM reductions represent less than 1.0% of the total land area and permitted AUMs, respectively.

Successful reclaimed sites produce at a rate of about 6 acres per AUM (PFO-BLM 1997) which is more than twice the present 14 acres per AUM stocking rate for the Rock Springs allotment. Reclamation of disturbed sites with grasses and forbs could cause a localized increase in the availability of livestock forage and depending upon the intensity of use (grazing by wildlife, wild horses, and livestock) could interfere with revegetation success of reclaimed areas and fencing may be required to avoid overuse and to assure successful reclamation of the site. Prevention and control of invasive weed species would be a positive impact to livestock by reducing competition with indigenous plants, thereby maximizing forage production.

The Proposed Action increases the potential for livestock/vehicle collisions. However, if Anadarko advises project personnel regarding appropriate speed limits on designated access

roads and these instructions are complied with, the likelihood of livestock/vehicle collisions would be minimized.

Table 4-12. Estimated Reduction of Animal Unit Months in the Rock Springs Grazing Allotment (13017) due to Land Surface/Vegetation Disturbance for the Proposed Action and No Action Alternatives.

Land Ownership Status	Estimated Total Initial Disturbed Area (acres)	Estimated Total Initial Animal Unit Months (AUM) Reduction	Estimated Total Life-of-Project (LOP) Disturbance Area (acres)	Estimated Total Life-of-Project (LOP) Animal Unit Months (AUM) Reduction
PROPOSED ACTION				
Federal	231.1[1](0.01%)[2]	16.5[3] (0.01%)[4]	78.3 (0.004%)	5.6 (0.004%)
State	11.3 (0.0006%)	0.8 (0.0006%)	3.8 (0.0002%)	0.27 (0.0001%)
Private	260.2 (0.01%)	18.6 (0.01%)	88.7 (0.005%)	6.3 (0.0002%)
TOTAL	**502.6 (0.03%)**	**35.9 (0.024%)**	**170.8 (0.009%)**	**12.2 (0.006%)**
NO ACTION ALTERNATIVE				
Federal	65.5 (0.003%)	4.7 (0.0024%)	16.4 (0.009%)	1.2 (0.0006%)
State	31.3 (0.002%)	2.2 (0.002%)	3.8 (0.0002%)	0.27 (0.0001%)
Private	260.2 (0.01%)	18.6 (0.01%)	88.7 (0.005%)	6.3 (0.0002%)
TOTAL	**357.0 (0.02%)**	**25.5 (0.016%)**	**108.9 (0.006%)**	**7.8 (0.004%)**

[1] See Table 2-1 (p. 2-4) for individual gas field component acreage (e.g., compressor station, road and pipeline construction, well pads, etc).

[2] Percentage (in parenthesis) of total acres affected based on an estimated total of 1,913,364 acres within the Rock Springs Grazing Allotment (K. Lloyd, RSFO-BLM, Pers. Comm. 2003).

[3] AUMs calculated for Rock Springs Grazing Allotment based on historical stocking rate of 14 acres per AUM and 1 AUM = 780 lbs forage/month (K. Lloyd, RSFO-BLM, Per. Comm. 2003).

[4] Percentage (in parenthesis) of affected Animal Unit months (AUM) based on total of 180,234 AUMs permitted for the Rock Springs Grazing Allotment (K. Lloyd, RSFO-BLM, Pers. Comm March 2003).

4.6.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar, but reduced in scope, to those described under the Proposed Action. Under the No Action Alternative, disturbances to the rangeland resource located in proximity to roads and existing facilities would continue due to vehicular use and continued gas field-related activities. Consideration of individual APDs by the BLM on federal lands could continue on a case-by-case basis through individual project and site-specific environmental analysis. Additional gas development could occur on State and private lands within the CRPA under APDs approved by the WOGCC.

Under the No Action Alternative, an estimated 357 acres (Proposed Action = 583 acres) would be disturbed initially due to continuing gas-related activity which represents about 1.4% of the CRPA and about 0.02% of the total land area of the Rock Springs grazing allotment. As site reclamation proceeds, the estimated LOP disturbance acres is reduced from 337 to 109 acres which represents about 0.43% 0f the CRPA and 0.006% of the total land area of the Rock Springs grazing allotment (Table 4-13).

Under the No Action Alternative, the estimated reduction of initial AUMs would be about 25.5 AUMs which represent about 0.02% of the total permitted AUMs for the Rock Springs grazing allotment. The estimated LOP reduction in total AUMs would stabilize at about 7.8 AUMs or about 0.005% of the total permitted AUMs for the Rock Springs grazing allotment (Table 4-13).

4.6.2 Mitigation

No additional mitigation would be required.

4.6.3 Residual Impacts

No adverse residual impacts are expected to occur as a result of project implementation, provided the guidelines and mitigation measures provided in this document and the RMP are successfully implemented.

4.7 WILDLIFE

4.7.1 Impacts

4.7.1.1 Proposed Action

Over the four-year proposed drilling period, approximately 89 wells would be drilled, disturbing approximately 583.4 acres of general wildlife habitat. The precise number and location of wells may change as directed by the success of developmental drilling, production technology, and economic profitability.

During the production phase, the unused portion of well sites and roads, as well as pipelines (a total of 331.7 acres) would be reclaimed leaving up to 170.8 acres disturbed over the LOP. Following completion of production operations (life of the project is estimated at 15-20 years), the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed and the areas revegetated with seed mixes approved by the BLM, some of which are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to predisturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation; however, much more time would be required to achieve reestablishment of shrub communities. Consequently, disturbance of shrub communities, particularly mixed shrub communities that big game utilize during winter, would result in a long-term loss of those habitats.

In addition to the direct loss of habitat due to construction of well pads and associated roads and pipelines, disturbances from human activity and traffic would lower the utilization of habitat immediately adjacent to these areas. Species that are sensitive to indirect human disturbance

(noise and visual disturbance) would be impacted most. Habitat effectiveness of these areas would be lowest during the construction phase when human activities are more ubiquitous and intensive. Disturbance would be reduced during the production phase of operations and many animals may become accustomed to equipment and facilities in the gas field and may once again use habitats adjacent to disturbance areas.

4.7.1.1.1 General Wildlife

The direct disturbance of approximately 583.4 acres of wildlife habitat under the Proposed Action would reduce habitat availability and effectiveness for a variety of common small mammals, birds and their predators. The initial phases of surface disturbance would result in some direct mortality and displacement of songbirds and small mammals from construction sties. In addition, some increase in mortality from increased vehicle use of roads in the project area is expected. Quantification of these losses is not possible; however, the impact is likely to range from low to moderate over the short-term. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed, small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation of pipelines, unused portions of roads, well pads, and wells that are no longer productive. No long-term adverse impacts to populations of small mammals and songbirds are expected.

4.7.1.1.2 Big Game

In general, impacts to big game wildlife species would include direct loss of habitat and forage, and increased disturbance from drilling, construction, and maintenance operations. Disturbance of big game species on winter range can increase stress and may influence species distribution (Hayden-Wing 1980, Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly during winter. The potential for vehicle collisions with big game would likely increase as a result of increased vehicular traffic and speeds associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the operations.

Mule Deer. The project area supports mule deer year round. Approximately 5% of the project area is classified as mule deer crucial winter/yearlong range and 95% of the project area is classified as mule deer winter yearlong range. An estimated four wells would be located in mule deer crucial winter/yearlong range; total disturbance associated with these wells would be approximately 28.2 acres (Table 4-13), or 2.5% of the crucial winter/yearlong range in the project area. Following reclamation, approximately 8.2 acres of crucial winter/yearlong range would remain disturbed for the remaining life of the project. An estimated eighty-five wells would be located in winter yearlong range, disturbing a total of 555.2 acres, or 2.3% of the winter yearlong range in the project area.

During winter, mule deer primarily utilize shrubs including sagebrush, mountain mahogany, and antelope bitterbrush (DeBolt 2000). Mountain mahogany is also an important mule deer forage during the spring, summer, and fall (DeBolt 2000). Specific placement of roads and wells to avoid destroying habitat patches containing these shrub species would lessen the impact upon the crucial winter range vegetation in the project area. Overall, impacts upon mule deer winter habitat should be limited and no long-term impacts to mule deer in the area are expected because a very small percent (2.5%) of the crucial winter/yearlong range would be disturbed and similar habitats are available in the surrounding area.

Table 4-13. Summary of Impacts (Acres) on Big Game Seasonal Ranges with Construction of the Proposed Action.

Species Range Type	Area (ac)	Well Pads		Roads (ac)	Pipelines (ac)	Compressor (ac)	Total (ac)	%[1]
		#	ac					
Mule Deer								
Crucial Winter Yearlong	1108	4	8	8.1	12.1	0	28.2	2.5
Winter Yearlong	23845	85	170	153.7	230.6	0.9	555.2	2.3
Totals	24953	89	178	161.8	242.7	0.9	583.4	2.3
Elk								
Yearlong	55	0	0	0	0	0	0	0
Undetermined	24898	89	178	161.8	242.7	0.9	583.4	2.3
Totals	24953	89	178	161.8	242.7	0.9	583.4	2.3
Pronghorn Antelope								
Winter Yearlong	22520	80	160.2	145.6	218.4	0.9	525.1	2.3
Crucial Winter/Yearlong	2433	9	17.8	16.2	24.3	0	58.3	2.4
Totals	24953	89	178	161.8	242.7	0.9	583.4	2.3

[1] - Percentage of each type disturbed

Disturbance is also a factor that should be considered for big game species. According to management directives in the RMP, crucial big game winter ranges will be closed from November 15 - April 30. This closure of areas located in mule deer crucial winter/yearlong range would reduce disturbance to mule deer wintering on the project area. No adverse impacts upon the mule deer population utilizing the project area are expected provided that mitigation measures contained in this document and the RMP are implemented.

Elk. Very little of the project area supports elk during anytime of the year with less than 0.1% of the project area classified as yearlong elk winter range. The remainder of the project area (over 99%) is of undetermined value and has not been classified as any type of elk seasonal range. Therefore, nearly all of the disturbance associated with the project would occur in areas of undetermined value to elk.

During winter, elk utilize most of the same shrub species preferred by mule deer, but prefer grasses when they are available. Spatial separation of elk and mule deer on the winter range may occur (Hayden-Wing 1980), but they often utilize the same areas (DeBolt 2000). Overall, impacts upon elk habitat would be negligible.

Pronghorn. The project area supports pronghorn throughout the year. Approximately 90% of the project area is classified as winter yearlong pronghorn range, and approximately 10% of the

project area is classified as crucial winter/yearlong pronghorn range. An estimated 80 wells would be located in winter yearlong pronghorn range; total disturbance associated with these wells would be approximately 525.1 acres (Table 4-13), or 2.3% of the winter yearlong pronghorn range in the project area. Following reclamation, approximately 152.3 acres of winter yearlong pronghorn range would remain disturbed for the remaining life of the project. An estimated 9 wells would be located in crucial winter/yearlong pronghorn range; total disturbance associated with these wells would be approximately 58.3 acres, or 2.4% of the crucial winter/yearlong pronghorn range in the project area. Following reclamation, approximately 16.9 acres of crucial winter/yearlong pronghorn range would remain disturbed for the remaining life of the project.

Pronghorn crucial winter/yearlong range is located only in the northern portion of the project area and winter yearlong range covers the remainder of the project area. Activities associated with the construction phase of the project would likely temporarily displace pronghorn, however, once construction is complete pronghorn would likely habituate and return to pre-disturbance activity patterns. Reeve (1984) found that pronghorn acclimated to increased traffic volumes and machinery as long as the traffic and machines moved in a predictable manner. The displacement of pronghorn and disturbance of habitats is considered a short-term impact because of the temporary nature of the displacement and the availability of comparable habitats in adjacent areas.

4.7.1.1.3 Upland Game Birds

Greater Sage-grouse. Under the Proposed Action, 583.4 acres of the Wyoming big sagebrush vegetation cover type would be disturbed during construction and 170.8 acres in the long-term if all wells were productive. This amount of habitat disturbance is minimal (0.7% long-term) considering the amount available in the project area, however, sage grouse can be impacted by other activities associated with development including increased human activity, increased traffic disturbance, and pumping noises. Sage grouse exhibit site fidelity to leks, winter areas, summer areas, and nesting areas (Eng 1963, Dunn and Braun 1985). Therefore, steps, i.e. those described in Section 2.1.11.2.9, would ensure that impacts to these areas, especially leks and nesting areas, are minimized. Four active sage grouse leks have been identified on or within two miles of the project area (Figure 3-11).

Additional surface disturbance would be avoided within 1/4 mile of the two sage grouse leks within the project area boundary. Approximately 251 acres in the project area are located within the 1/4-mile buffer of those lek locations. Additionally, construction activities within a two-mile radius of active leks would be restricted between March 1 and June 30 to provide protection for grouse during the egg-laying and incubation period. Exceptions may be granted if the activity will occur in unsuitable nesting habitat. If all avoidance and mitigation measures identified in this document and the RMP are implemented, impacts to greater sage-grouse are expected to be minimal.

Mourning Dove. Mourning doves are known to breed in areas west of the project area, and it is likely that some limited breeding activity and nesting occurs on the project area. The project area is located in UGMA #6, in which only 1.8% of the state's total harvest of mourning doves occurred in 2001 (WGFD 2002b). Mourning dove habitat on the project area is marginal in quality and disturbances that may occur are not expected to impact this species.

4.7.1.1.4 Waterfowl and Shorebirds

Habitat for waterfowl and shorebirds is very limited on the project area. Given mitigation measures for water resources identified in this document and in the RMP, it is expected that the Proposed Action would not have impacts upon waterfowl or shorebirds.

4.7.1.1.5 Raptors

The potential impacts of the Proposed Action on raptors are : (1) nest abandonment and/or reproductive failure caused by project related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) small, temporary reductions in prey populations.

The primary potential impact to raptors from project activities is disturbance during nesting that might result in reproductive failure. To minimize this potential, disturbance would not be allowed during the critical nesting season (Feb. 1 - July 31, depending on the species) near raptor nesting habitat. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether or not the nest is within the line of site to construction activities. Nests will be considered active if they were used within the past three years. No active raptor nests were located on the CRPA during 2003. If active raptor nests are located on the project area in future years, appropriate avoidance and mitigation measures would be taken to avoid impacts to breeding raptors.

4.7.1.1.6 Wild Horses

The Proposed Action is estimated to initially reduce available Animal Unit Months (AUMs) by about 45.6 AUMs which represents about 0.03% of the total 180,234 AUMs permitted for the Rock Springs grazing allotment (Lloyd 2003). During the estimated LOP, this total is estimated to decrease to about 15.4 AUMs which represents about 0.008% of the total permitted AUMs for the allotment.

Surface disturbing activities associated with the construction of well pads, reserve pits, and roads could adversely affect wild horses. Land clearing and grading activities necessary for construction remove vegetation (i.e., result in loss of forage resources) and create disturbance by increased human activity. BLM standards for reclamation of disturbed sites, such as linear road and pipeline ROWs and well pad sites are adequate to mitigate any potential adverse effect on wild horses due to vegetation removal. Effects of the Proposed Action would be temporary, as the vegetative conditions on most sites are ultimately reclaimed and return to pre-existing levels.

The short-term impacts of vegetation disturbance/removal on wild horses due to project activities is anticipated to be minor because the maximum initial disturbed area represents only 0.03 % of the total 1,913,364 areas within the Rock Springs gazing allotment As previously discussed, the estimated initial figure of 583 acres probably represents a maximum figure which would likely decrease, depending on the number and acreage of existing facilities and infrastructure that may be utilized by Anadarko during the course of the project. In addition, the fairly flat terrain of the CRPA may permit a number of drill pad sites to be leveled with minimal vegetation disturbance.

Because of increased vehicular activity, the Proposed Action has the potential to increase horse/vehicle collisions. However, if Anadarko advises project personnel regarding appropriate speed limits on designated access roads, the likelihood of horse/vehicle collisions would be minimized. The wary nature of wild horses and general avoidance of traveled roads also decreases their possibility of being struck by a vehicle.

Preventing and containing the spread of noxious and invasive plant species would be a positive impact to wild horses by reducing competition with native plants, consequently maximizing forage production.

Displacement of wild horses from the CRPA to areas outside the HMA boundary is estimated to be minimal due, in large part, to:

(1) Long-term habituation of wild horses to existing oil and gas activities - The project area overlies an area already developed by two existing oil and gas projects including the Brady and Jackknife Spring Field's which have been in operation since 1972. Wild horses have experienced humans, vehicles, and oil/gas patch-related activities in this area of their habitat for more than 31 years;

(2) Anadarko estimates that 2-4 years would be required to complete the project which provides a fairly wide-window of time for actual drilling activities, thus decreasing the potential concentration and number of drilling operations/vehicles/and people at any particular location, time or season;

(3) By their nature, free-roaming wild horses in the Salt Wells HMA have shown the innate capacity to disperse over wide areas in search of food and water, seek shelter, or to escape insect pests and human activity and;

(4) Transboundary movement of wild horses to adjoining HMAs is currently common between the shared, unfenced, border of the Adobe Town HMA and the Salt Wells HMA. As stated in Chapter 3, the AML for the Salt Wells HMA has never been achieved because of this unrestricted movement, the vast area of the two HMAs, and the existing selective removal criteria.

Because the CRPA is composed entirely of checkerboard lands, effective restrictions on wild horse population size exist as a result of several legal actions brought against the Department of Interior (DOI) by the Rock Springs Grazing Association (RSGA) beginning in 1979. In March 1981, the District Court ordered that the appropriate level for horse herds on the Salt Wells/Pilot Butte checkerboard lands, "is the level agreed to by the landowners and that all horses above such levels are excess within the meaning of the Act". (BLM-RSFO 1999a)

Primary public access to view wild horses in and near the project area is via U.S. Hwy 430, Sweetwater County Road's 4-24 and 4-26, and numerous access roads already present in the CRPA. The Proposed Action would not affect the opportunity for the public to view wild horses.

4.7.1.2 Alternative A - No Action

Under the No Action Alternative, the Proposed Action would not be implemented, however, the transport of natural gas products would be allowed from those wells in the CRPA that are currently in production. Direct and indirect impacts to wildlife would continue on federal lands as additional individual exploratory and development activities are considered by the BLM on a case-by-case basis. Impacts to wildlife would be similar to those described for the Proposed Action, but of a lesser magnitude.

Under the No Action Alternative, direct and indirect wild horse impacts could continue as additional exploratory and development activities beyond this EA are permitted by the BLM or allowed by private individuals and/or the RSGA. The impacts of project–related activity under the No Action Alternative are shown in Table 4-13. The No Action Alternative would initially reduce available AUMs to an estimated total of 32.4 AUMs (Proposed Action = 45.6 AUMs). The estimated total LOP AUM reduction is about 9.9 AUMs which represents about 0.005% of the total permitted AUMs for the Rock Springs grazing allotment.

4.7.2 Mitigation

No additional mitigation is required.

4.7.3 Residual Impacts

Although the potential impacts associated with the Proposed Action would be minor, the effects of some would persist until they were off-set over time. Such effects would include the: (1) long-term loss of 28.2 and 58.3 acres of crucial winter range for mule deer and pronghorn, respectively, and (2) long-term reduction of potential sage-grouse nesting habitat.

Construction of new roads may also cause long-term impacts such as increased human disturbance of wildlife near those roads and an increased potential for wildlife/vehicle collisions, poaching, and harassment.

Residual impacts to the wild horse resource are anticipated to be minor and short-term with implementation of and compliance with mitigation measures and stipulations stated in Chapter 2 of this EA, Anadarko's APDs, and the RMP.

4.8 SPECIAL STATUS WILDLIFE, FISH AND PLANT SPECIES

4.8.1 Threatened, Endangered or Proposed for Listing Species of Wildlife, Fish, and Plant

4.8.1.1 Fish

Formal consultation with the FWS for endangered fish species found in the Upper Colorado River System has been completed. Consultation concluded that since water depletions would average 10.11 acre-feet per year, or 40.46 acre-feet for the project, is below the threshold of 100 acre-feet criteria set for the recovery program, the depletion fee has been waived (August 29, 2003). No further direct, indirect, or cumulative impacts to endangered fish are anticipated.

4.8.2 Sensitive Wildlife, Fish, and Plant Species

Although these species have no legal protection under the ESA, the BLM and FWS still maintain an active interest in their numbers and status. All of these species may have the potential to occur on or near the project area and, therefore, potential impacts to them, that may be caused by the Proposed Action, are considered.

4.8.2.1 Proposed Action

4.8.2.1.1 Mammals

Swift Fox. Some portions of the project area may provide limited foraging habitat, however, swift foxes are very adaptable, and the limited amount of disturbance would not result in impacts to swift foxes, if they are present on the CRPA.

Wyoming Pocket Gopher. The Wyoming pocket gopher may be present in portions of the CRPA. This species utilizes dry ridge tops with dry gravelly soils and greasewood. This species may be abundant within its distribution, but no population studies have been conducted (Clark and Stromberg 1987). No impacts to this species are expected with development of the Proposed Action because habitat disturbance within the CRPA from development would be minimal.

Pygmy Rabbit. Pygmy rabbits are limited to areas of dense and tall big sagebrush (Campbell et al. 1982, Clark and Stromberg 1987, Heady et al. 2002). Although the project area is dominated primarily by Wyoming big sagebrush, and no pygmy rabbit occurrence has been reported within six miles (WGFD 2002c, WYNDD 2002), the possibility exists that pygmy rabbits occur in the CRPA. Approximately 568 acres of Wyoming big sagebrush habitat would be disturbed under the Proposed Action. This loss of pygmy rabbit habitat could result in the direct mortality of some individuals and displace others into surrounding areas of lesser quality habitat; however it is unlikely the population would be impacted because only 2.3% of the Wyoming big sagebrush habitat found within the project area would be disturbed. If pygmy rabbits are found to occur on the project area, potential impacts to them could be reduced by avoiding well, road, and pipeline placement within areas of tall dense sagebrush.

4.8.2.1.2 Birds

Mountain Plover. Although ideal mountain plover habitat does not occur in the project area, some areas of potential mountain plover habitat do occur, and these areas may provide limited nesting opportunities. No mountain plover sightings were reported in the WOS (WGFD 2002c) or the WYNDD (2002). No mountain plovers were observed in the potential habitat areas on the CRPA during surveys conducted in May and June 2003. A portion of the potential mountain plover habitat may be disturbed with implementation of the proposed action. Impacts to mountain plovers would be minimized by avoiding construction activities in suitable plover nesting habitat during the nesting period from April 10 -July 10, and/or avoiding surface disturbance within areas of potential mountain plover habitat the remainder of the year. The exact location of mountain plover nests may change annually, and mountain plover nest activity status and location must be kept current. For this reason, it is recommended that surveys for mountain plovers be conducted, within areas of potential habitat, prior to any surface disturbance in those areas, according to current mountain plover survey protocol (USDI-FWS

2002). No impacts to mountain plovers are expected provided that avoidance and mitigation measures outlined in this document and the RMP are implemented.

Sage Thrasher. The sage thrasher is considered a sagebrush obligate and is generally dependent on large patches and expanses of sagebrush steppe for successful breeding. Sage thrashers have been observed throughout Wyoming, including areas near the CRPA (WGFD 2002c). Development of the Proposed Action would likely displace some sage thrashers, however, suitable habitat is very abundant throughout the project area, and no impacts to this species are expected.

Loggerhead Shrike. Two records of loggerhead shrikes are documented within six miles of the CRPA. This species uses thickly foliaged trees and shrubs for nesting and roosting. Construction within this type of habitat may possibly disturb nesting shrikes. However, facilities associated with well development may provide increased perching sites, which shrikes use for hunting. Implementation of the Proposed Action is not likely to adversely affect the loggerhead shrike.

Brewer's Sparrow. The Brewer's sparrow breeds in landscapes dominated by big sagebrush (*Artemisia tridentata*) throughout the Great Basin and intermountain West (Rotenberry et al. 1999). Brewer's sparrows are likely present throughout the project area where suitable habitat occurs. Development of the Proposed Action would likely displace some Brewer's sparrows, however, suitable habitat is very abundant throughout the project area, and therefore, no impacts to this species are expected.

Sage Sparrow. Sage sparrows typically utilize stands of big sagebrush or mixed big sagebrush and greasewood for nesting. It is possible that the sage sparrow, a sagebrush-obligate species, may be present within the CRPA. Because of the small amount of disturbance associated with the project, their inherent mobility, and the availability of suitable habitats on undisturbed land, the impact to sage sparrows is expected to be minimal.

Burrowing Owl. Burrowing owls typically utilize areas located in active prairie dog towns where burrows are readily available (Butts 1973). Although white-tailed prairie dog colonies are present on the project area, burrowing owl sightings have not been reported on or within six miles of the project area. If nesting owls are found on the CRPA during future raptor nest surveys, the same measures used for other raptor species would be applied. Given these precautionary measures, no adverse impacts to burrowing owls are expected to result from the implementation of the Proposed Action.

4.8.2.1.3 Reptiles

Midget-faded Rattlesnake. In Wyoming, the midget-faded rattlesnake inhabits the lower Green River valley from the cities of Green River and Rock Springs south to the Utah-Wyoming state line. In southwestern Sweetwater County the midget faded rattlesnake is commonly found among rock outcroppings (Baxter and Stone 1992). The documented distribution of the midget-faded rattlesnake in Wyoming is south of the CRPA. However, the full extent of its range is not well known and the snake could potentially occur, although unlikely because of the lack of suitable habitat. Implementation of the Proposed Action is not expected to impact midget-faded rattlesnakes if present.

4.8.2.1.4 Amphibians

Great Basin Spadefoot Toad. Limited habitat exists in the area; however, it is possible that Great Basin spadefoots utilize the intermittent and temporary water sources for breeding during years with adequate moisture. If measures are taken to avoid disturbance of water sources, no adverse impacts to this species are expected from implementation of the Proposed Action.

4.8.2.1.5 Fish

The drainages in the project area are ephemeral or intermittent. Five fish species of special concern occur downstream of the CRPA: roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), and the leatherside chub (*Gila copei*, [BLM 2002]). Produced water would be disposed of in existing water disposal wells; therefore, project activities should not affect these fish species of concern found downstream from the CRPA.

4.8.2.2 Alternative A - No Action

Under the No Action Alternative, the Proposed Action would not be implemented, however, continued drilling on privately–owned lands would occur and transport of natural gas products would be allowed from those wells in the CRPA. Direct and indirect impacts to special status wildlife, fish, and plant species would continue as additional individual exploratory and development activities are considered by the BLM on a case-by-case basis. Impacts to special status wildlife, fish, and plant species resource would be similar to those described for the Proposed Action, but of a lesser magnitude.

4.8.2.3 Mitigation

To reduce potential impacts to pygmy rabbits, tall sagebrush (> 4ft) should be avoided where possible.

4.8.2.4 Residual Impacts

No adverse residual impacts are expected to occur with project implementation, assuming successful implementation of the proposed measures.

4.8.3 Migratory Birds

4.8.3.1 Proposed Action

Past and recent infill gas production and associated infrastructure activities have left the area with fragmented habitat. Reclamation to stabilize soil and reduce windborne dust has helped tie some of these fragmented habitats with an edge of mixed grasses. Some old stands of native vegetation will be lost over the short-term and eventually converted to early succession species. This will result in some species (mourning dove, etc) declining in nesting success, while other species (horned lark) will show increased nesting.

Water produced from shallow gas production is presently and in the future will be injected into deep saline formations. No adverse impacts to migratory birds are anticipated from the

dewatering process. An increase in traffic could lead to bird collisions and road building will reduce available nesting.

4.8.3.2 No Action

Under the No Action Alternative, the Proposed Action would not be implemented, however, continued drilling on privately–owned lands would occur and transport of natural gas products would be allowed from producing wells in the CRPA. Direct and indirect impacts to migratory birds would continue as additional individual exploratory and development activities are considered by the BLM on a case-by-case basis.

4.8.3.3 Mitigation

No additional mitigation is required.

4.8.3.4 Residual Impacts

No adverse residual impacts are expected to occur with project implementation, assuming successful implementation of the proposed measures.

4.9 RECREATION

4.9.1 Impacts

4.9.1.1 Proposed Action

The CRPA includes two existing oilfields. Recreation use in the CRPA and immediately adjacent areas is believed to be minimal, at least in part because of the level of oil and gas development in the area and the availability of less developed areas in southern Sweetwater County. Few, if any, recreation users would be displaced by drilling and field development activities. Consequently, impacts to the recreation resource would be minimal due to the short-term nature of drilling and construction activities and small number of recreation users affected.

4.9.1.2 No Action

Under the No-Action alternative up to 48 wells could be drilled including 46 on private surface and 2 on state lands, or about 54 percent of the wells associated with the Proposed Action. Wells on public lands could potentially be drilled on a case by case basis. As with the Proposed Action, recreation impacts would be short-term and few recreation users would likely be affected. Therefore, only minimal impacts to recreation resources would be expected under the No Action alternative.

4.9.2 Mitigation

Given the minimal level of recreation impacts anticipated, no additional recreation mitigation measures are proposed beyond those identified in Chapter 2.

4.9.3 Residual Impacts

No residual recreation impacts are anticipated.

4.10 VISUAL RESOURCES

4.10.1 Impacts

4.10.1.1 Proposed Action

The Proposed Action would result in an intensification of the existing visual character within the CRPA, and long-term impacts associated with new resource roads and reclaimed well pads would be anticipated. Given the operator-proposed mitigation measures, these impacts would be within the guidelines for VRM Class IV areas. Reclamation of existing shortcut roads and other unnecessary disturbance would help the BLM meet its objectives for the VRM Rehabilitation area.

Impacts to visual resources associated with construction and drilling in the CRPA would include contrasts in line, form, color, and texture. In the short term (two to four years), these contrasts would be associated with surface disturbance, drilling rigs, construction equipment, service trailers and the general industrial character of drilling activities. Additional impacts could occur from fugitive dust produced by construction activities. In the longer term, contrasts would be associated with well facilities, access roads and ancillary facilities.
Potential reviewers of these contrasts would primarily be oil and gas field workers, grazing operators and recreation users passing through the area. Activity in the CRPA would not be visible from WYO 430.

In the BLM's VRM rating system, the severity of impact is related to the scenic quality, sensitivity level, and distance zone of the affected environment. The portion of the Proposed Action that would occur within the existing Brady and Jacknife Spring fields would result in an intensification of the existing character of the landscape. In the areas of the CRPA that have been previously undisturbed, the level of contrast would be somewhat higher but still visible to relatively few viewers. New disturbance, well pads and ancillary facilities located within view of county roads in these previously undisturbed areas would comprise the highest level of contrast. Visual effects would be most evident during the two to four-year drilling and field development phase of the project, when drilling rigs and construction equipment would be commonly seen, and disturbance for well pads and linear facilities would be relatively fresh. As drilling and field development is completed and disturbed areas are reclaimed, visual impacts would become less evident.

Given the operator-committed mitigation and reclamation measures described Chapter 2, the activities associated with the Proposed Action would be within VRM Class IV guidelines.

Portions of the CRPA are located within a VRM rehabilitation area, which was designated by the BLM due to a number of un-reclaimed shortcut roads and other unnecessary disturbance in the area. The reclamation objective is to improve the visual quality of the Rehabilitation area to that of the surrounding VRM classification, in this case, VRM Class IV. As part of its transportation planning process, Anadarko has committed to closure and reclamation of unnecessary roads and other disturbances, which would help achieve the BLM’s objectives in this VRM rehabilitation area (Deakins 2002).

4.10.1.2 No Action

Under the No Action alternative, up to 48 wells could be drilled on private and state lands. Additional wells could be drilled on federal lands on a case by case basis. Therefore visual impacts similar in nature to the Proposed Action could occur under the No Action alternative, although at diminished levels. The effects on the visual resource would be dependent on the level of development on private and state lands, the number of individually approved wells and ancillary facilities on public lands, the location of wells and ancillary facilities and the private and state requirements for visual impact mitigation.

4.10.2 Mitigation

Reclamation of old shortcut roads would reduce existing visual impacts.

4.10.3 Residual Impacts

Even after application of proposed measures, wellhead facilities, ancillary facilities and access roads would be visible for the life of the project, but these facilities would be within the guidelines for VRM Class IV areas.

4.11 CULTURAL RESOURCES

4.11.1 Impacts

4.11.1.1 The Proposed Action

The CRPA data base contains 70 sites in a 24,953 acre area. Sites include prehistoric open camps consisting of habitation sites and features. The prehistoric lithic debris sites are categorized as lithic scatters and secondary procurement sites.

The historic sites include ranching/stock herding sites, local transportation roads, and debris scatters. Prehistoric/historic sites are grouped into prehistoric camps with ranching activities and/or historic debris. Of the recorded cultural resources, 31.5% are recommended eligible for nomination to the NRHP, 31.5% are recommended not eligible for nomination to the NRHP, 36% remain unevaluated to the National Register, and 1% has been destroyed.

Potential impacts to specific eligible or unevaluated properties are unknown at this time. Portions of the study area are contained within the developed Brady and Jackknife Spring Fields. These fields were developed as early as 1972. Access to the field would be via U. S. Highway 430 , Sweetwater County Road 4-26, and existing improved roads. Projects (n=134) conducted in the Copper Ridge study area encompasses 38.989 square miles or 24,953.01 acres. Approximately 3619 ac (block) or ca. 14.5% of the analysis area have been inventoried at Class III or Class II level. The overall site density within the study area varies with the highest number of sites located along drainages. Black Buttes Creek and Sand Wash and their ephemeral drainages contain many of the known sites in the study area as do the juniper covered ridge tops. Certain topographic settings have a higher archaeological sensitivity such as eolian deposits (sand dunes, sand shadows, and sand sheets), alluvial deposits along major

drainages, and colluvial deposits along lower slopes of ridges.

Adverse effects could be in the form of direct, indirect, or cumulative impacts. Direct impacts would primarily result from construction related activities and would be considered serious if lost information impeded efforts to reconstruct the prehistory or history of the region. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities, and the construction of roads and pipelines. Sites located outside the APE would not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the project is judged to have no effect. Mitigation is the response for those sites that fall within the APE resulting in the loss of important information. Alteration of the environmental setting of eligible historic properties may be considered an adverse effect in the form of a direct impact.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

4.11.1.2 No Action Alternative

Under the No Action alternative drilling and field development could occur on private lands and possibly on public lands on a case by case basis. Consequently, impacts to cultural resources similar in nature to the Proposed Action could occur under the No Action alternative, although at diminished levels.

4.11.2 Mitigation

No additional mitigation measures are necessary.

4.11.3 Residual impacts

Avoidance of known important cultural resources during construction projects and implementation of Class III cultural resource inventories for the proposed actions minimizes the potential for adverse impacts to cultural resources. However, despite all of the proposed measures for protection of cultural resources, the potential exists that these resources could accidentally be damaged if not identified prior to construction activities.

4.12 SOCIOECONOMICS

4.12.1 Impacts

4.12.1.1 Proposed Action

Socioeconomic effects of the Proposed Action would be largely positive. The project would enhance regional economic conditions and generate local, state and federal government tax and royalty revenues. The relatively small, short-term drilling and field development workforce

would generate minimal demand for temporary housing or local government services. Consequently no substantial negative socioeconomic impacts are anticipated.

Economic and Employment Effects

Development and operation of the Proposed Action would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry and from other industries. Expenditures by the proponent for these goods and services, coupled with employee and contractor spending, would generate both direct and indirect economic effects in southwest Wyoming, elsewhere in the State of Wyoming and in the nation as a whole.

For the Proposed Action, direct drilling and field development employment was estimated by assuming a two-year drilling and field development schedule, and by simulating a drilling season, using the per-well employment estimates displayed in Table 2-2. Based on this simulation, drilling and field development employment associated with the proposed action would require between 20,000 and 21,000 worker days annually over the two year period, which equals about 80 full-time job equivalents.

Drilling and field development employment would average just under 100 workers per day during the eight month annual drilling period, with peak days of as much as 150 workers. Development of central compression facilities would require an additional 15 to 20 workers for a 45-day period.

Most drilling and field development work would be performed by contractors who would be on site for the duration of their task. In some cases, such as drilling contractors, these workers would work in the CRPA for months at a time, in other cases, workers would be on site for a matter of days or hours.

During project operations, some tasks would be performed by existing Brady Field employees and an average of 2 additional fulltime employees would be required. Each well would require workover operations every 1.5 years, during which time a crew of 4 or 5 workers would work at the well for a variable number of days, depending on the workover activities required at each well.

The Proposed Action as described in Chapter 2 of this assessment would involve an estimated $56 million capital investment in natural gas wells. A recent study prepared by the University of Wyoming Agricultural Economics Department (USBLM 2003), estimated employment, earnings and total economic impact associated with natural gas drilling and completion in the Jack Morrow Hills area, a portion of which is also in Sweetwater County. The study estimated that a drilled and completed coal bed methane well of less than 1,200 feet in depth would require $143,000 in direct expenditures and would generate $194,000 in total economic impact, $29,600 in total earnings and about one full-time equivalent job (all estimates are in inflation-adjusted 2001 dollars).

The study also estimated that a gas well drilled and completed to an average 9,000 feet would result in $620,784 in direct expenditures and would generate $847,000 in total economic impact, including $131,000 in earnings and 2.12 full time equivalent jobs.

The 89 wells associated with the Proposed Action are anticipated to range between 2,000 and 4,500 feet in depth. However, Anadarko estimates that each well would cost $620,000 to drill

and complete, which indicates that the wells in the Copper Ridge area would have economic effects similar to the conventional wells in the Jack Morrow Hills area. Using the estimates for conventional gas wells contained in the UW study, the drilling phase of the Proposed Action would generate an estimated $75 million in total economic impact, $11 million in total earnings and over 180 full-time equivalent jobs (direct and indirect).

The UW study also estimated the economic effects associated with 1,000 MCF of natural gas produced in southwest Wyoming at an average sales price of $2.81/MCF ($2001). These estimates included $2,793 in total economic impact in southwest Wyoming, $188 in earnings and .005387 jobs.

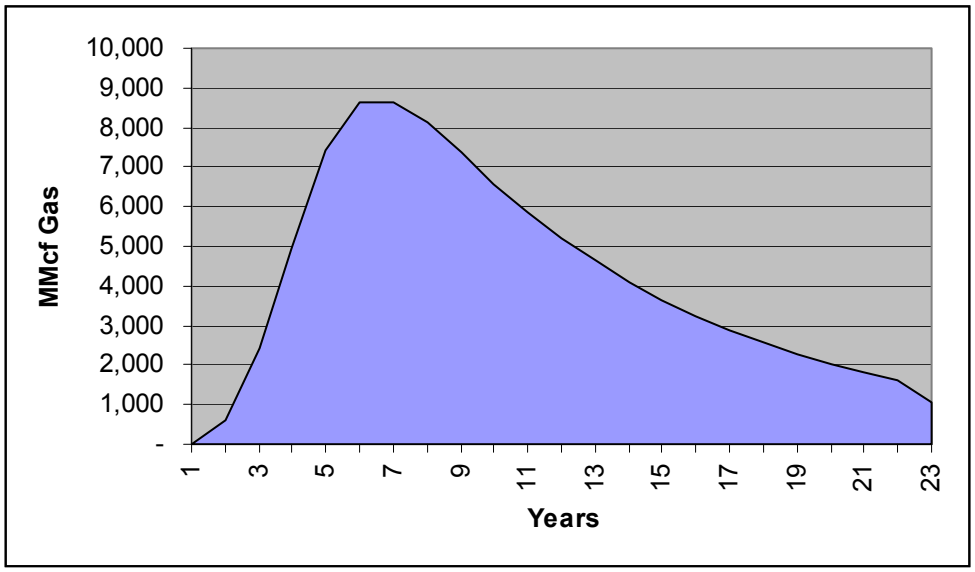
Anadarko anticipates that the 89 wells associated with the Proposed Action would produce an estimated 95.7 MMscf over 22 years. Based on the UW estimates, the 89 wells associated with the Proposed Action would generate an estimated total of $267 million in total economic impact in southwest Wyoming over 22 years, or an average annual economic impact of $12.1 million. This would include estimated total earnings of $18 million (an annual average of $818,000), associated with an annual average of 23 full-time equivalent direct and indirect jobs.

The foregoing assessment assumes that all wells would be successful. If some wells were dry, if production were less than anticipated, or if gas prices were lower than the EIA forecasts, the economic effects of the project would be lower than those presented above. Conversely, higher rates of production and/or gas sales prices would produce higher economic effects.

Sweetwater County Oil and Gas Activity

Successful completion of the Proposed Action would modestly increase natural gas production in Sweetwater County. Based on operator production forecasts, peak year Copper Ridge production (8,657 MMscf) would be about 4 percent of total 2001 Sweetwater County natural gas production.

Figure 4-2. Estimated Annual Proposed Action-Related Natural Gas Production



Sources: Anadarko, Blankenship Consulting LLC

Assuming that the 89 wells associated with the Proposed Action were drilled in two years, the annual increment in drilling would be about eight percent of all Sweetwater County APD's approved in 2001.

Population Effects

Direct and indirect population effects of the Proposed Action would be minimal. Drilling and field development activities associated with the Proposed Action would be performed by contractors, who may come from Rock Springs, from elsewhere in Wyoming or from out of state. Non-local contractors and their employees would be likely to locate to Sweetwater County temporarily, for the duration of their contract. Given the short-term nature of the drilling and field development phase of the project, non-local workers are likely to relocate to Sweetwater County single status, and return to their place of residence on their days-off and during periods when drilling ceases.

The relatively few direct jobs associated with project operations would not generate measurable population effects. The indirect jobs are likely to be filled by existing residents.

The economic activity associated with the Proposed Action would result in increased employment opportunities in other sectors of the economy, however, these indirect jobs are likely to be filled by existing residents rather than non-local workers. Consequently, the net effect of the Proposed Action may be to minimally slow population decline in Sweetwater County.

The preceding conclusions assume an overall level of regional oil and gas development similar to that of recent years. Section 4.12.5 discusses potential cumulative impacts associated with elevated levels of development.

Housing Demand

Non-local drilling and field development workers associated with the Proposed Action would be likely to seek temporary housing resources in the Rock Springs area. Existing temporary housing resources in Rock Springs could accommodate the relatively small Proposed Action-related demand for temporary housing. The operations phase of the Proposed Action would not generate appreciable housing demand.

Community Facilities, Law Enforcement and Emergency Response Demand

Most community infrastructure in Sweetwater County and Rock Springs has been sized to serve a larger population than currently exists. Therefore, the relatively small temporary population increases associated with the Proposed Action would be accommodated with existing county and municipal facilities. Emergency services demand associated with field development and operations activities would also be accommodated by existing Sweetwater County law enforcement and emergency management resources (Scofield 2003, Valentine 2003).

Fiscal Effects

The Proposed Action would generate certain state and local tax revenues including:

- local ad valorem property taxes on production and certain field facilities;

- sales and uses taxes to the State of Wyoming, Sweetwater County and its incorporated municipalities;
- mineral royalties to the federal government, a portion of which are returned to the State and local governments; and,
- state severance taxes.

The Proposed Action would generate ad valorem property tax revenue to Sweetwater County, the Wyoming School Foundation Fund, Sweetwater County Schools and various taxing districts within the county. Ad valorem taxes would be generated from two sources: 1) the fair market value of methane produced and sold; and 2) the value of certain capital facilities within the well fields (all underground facilities associated with wells are exempt by State statute).

Constant 2003 Sweetwater County mill levies were used to prepare the following estimates. In reality some mill levies are set each year by the Sweetwater County Commissioners, officials of the various special and school districts and the state; some change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity.

Based on Anadarko production estimates, US DOE Energy Information Administration price forecasts for natural gas (USDOE EIA 2003), and FY 2003 mill levies, the estimated Proposed Action-related gas production would generate $18.7 million (2001$) in ad valorem property taxes to all entities, or an average of $851,000 year. Note that peak production is not reached until several years after wells come on line, so early production years would yield lower revenues. Of the total property tax revenues, about 70 percent would be distributed to State and local schools and only about 17 percent would be distributed to Sweetwater County government.

A total of 41 of the 89 wells associated with the Proposed Action are anticipated to be on federal lands. The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund.

Based on Anadarko production estimates and USDOE EIA price forecasts for natural gas, an estimated total $13 million (2001$) in Federal Mineral Royalties would be generated by the Proposed Action; and approximately $6.5 million of that amount would be returned to the State of Wyoming. Actual Mineral Royalty revenues collected would vary based on actual production levels, gas sales prices, and production and transportation costs.

The State of Wyoming collects a six- percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and transportation costs are exempt from this tax. The state uses revenues from this fund for a variety of purposes (e.g., General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve) and returns a portion to counties and municipalities.

An estimated total $12.8 million ($2001) in severance taxes would be generated by the Proposed Action. Actual severance tax revenues would vary based on actual production levels, gas sales prices, and production and transportation costs.

Wyoming levies a four percent sales and use tax on the gross receipts of tangible goods and certain services (drilling services are exempted). The state returns 28 percent of the revenue (less administrative costs) to the county and municipalities where the taxes were collected. Sweetwater County also levies a one-percent local option sales and use tax, which is distributed to the county and its municipalities and a 0.5 percent facilities tax. Proceeds from the facilities tax would be used to fund construction of a new county jail.

In drilling the 89 wells associated with the Proposed Action, an estimated $28 million would be spent for goods and services subject to state and local sales and use taxes. This amount would generate about $1.5 million in total sales and use tax revenues, including $800,000 for the State of Wyoming and about $ 590,000 for Sweetwater County and its municipalities. The local option facilities tax would raise an estimated $140,000 from Proposed Action-related expenditures.

4.12.1.2 No Action

Under the No-Action alternative up to 48 wells could be drilled including 46 on private surface and 2 on state lands, which amounts to 54 percent of the wells associated with the Proposed Action. Consequently, using the same assumptions and methods as for the Proposed Action, the effects of the No Action would be similar in nature to those described for the Proposed Action, but at about half (54 percent) of the magnitude.

As with the Proposed Action, population effects of the No Action alternative would be minimal and result in little incremental demand for housing or for local government services.

Based on the same assumptions as the Proposed Action, direct employment associated with the No Action alternative could total about 11,000 worker days over a two-year field development period, or about 42 direct full-time job equivalents, assuming all 48 wells were drilled.

Using the multipliers obtained from the UW study, the drilling phase would generate about $41 million in total economic impact in southwestern Wyoming, including $6 million in earnings associated with 97 full-time equivalent jobs (direct and indirect). Under the No Action alternative, gas produced from the Copper Ridge field would generate an estimated $144 million in total economic impact in southwest Wyoming over the 22 year life of the field, including $10 million in wages associated with an annual average of 12 jobs.

Under the No Action alternative, production-related ad valorem taxes to all entities would total about $10.1 million over the life of the field. State severance taxes would yield about $7 million. There would be no federal mineral royalties associated with the No Action alternative. The drilling program would generate an estimated $810,000 in sales and use tax including about $432,000 for the state of Wyoming and $236,000 for Sweetwater County and its municipalities. The local option facilities tax would raise about $76,000.

4.12.2 Mitigation

No substantial negative socioeconomic impacts are anticipated to be associated with the either alternative. Anadarko should coordinate emergency response planning with the Sweetwater County Emergency Management Agency. The property and sales and use taxes associated with the Proposed Action would provide revenues to local governments in Sweetwater County to compensate for the anticipated minimal Proposed Action-related demand for law enforcement

and emergency response services. However, there would be a lag between the time development begins and the time substantial project-related tax revenues flow to the county.

4.12.3 Residual Impacts

No residual socioeconomic impacts are anticipated.

4.13 TRANSPORTATION

4.13.1 Impacts

4.13.1.1 Proposed Action

Transportation effects of the Proposed Action would occur primarily on WYO 430, SCR 4-26 and SCR 4-24. These public roads provide access to the CRPA from Rock Springs, where the majority of project related traffic would originate. Secondary transportation effects could occur on I-80, SCR 4-19 and SCR 4-84, although use of the latter routes for project access is anticipated to be minimal. Transportation impacts would also occur on operator-maintained roads within the CRPA. The increases in traffic associated with the Proposed Action could accelerate road maintenance requirements and generate short-term increased risk of accidents on state highways and county roads, but successful implementation of mitigation measures would help avoid these impacts.

The Proposed Action would primarily generate increases in traffic volumes on WYO 430, SCR 4-24 and SCR 4-26. These increases would result from the movement of project-related workers, equipment and materials to and from the project area to perform drilling, field development, well service, field operations and reclamation activities.

The largest increase in project-related traffic would occur during drilling and field development. Drilling of each well would generate an estimated 451 one-way trips, or an average of 11 trips per day over the 41 day drilling and completion cycle, and the peak daily traffic could be as high as 25 trips. Field development activities such as production testing, construction of gas gathering, water disposal, electrical power distribution and wellhead compression systems would raise average daily per well traffic to 13 trips, with peak days as high as 43 trips.

The Proposed Action anticipates drilling 89 wells in two to four years. For the transportation assessment, a two-year drilling period was assumed. It is also assumed that wildlife and seasonal stipulations would reduce the drilling period to 212 days in any given year. Based on these assumptions and a four-rig drilling and field development simulation, an estimated annual 19,760 one-way trips (9,880 round trips) would be generated by the Proposed Action during drilling and field development. This is an average daily traffic (ADT) of 93 one-way trips (46.5 round trips) per day over the 212-day drilling cycle, or an average annual daily traffic (AADT) increase of 54 trips on affected highways and roads. On peak days, traffic could reach 152 one-way trips (76 round trips). It is estimated that about 40 percent of all trips would involve trucks larger than 2½ tons. Note that these estimates reflect a two-year drilling schedule; if drilling and field development extends to three or four years, the annual number of trips would be reduced accordingly.

During project operations and reclamation, some trips would be combined with trips to serve existing Brady Filed wells and ancillary facilities. Incremental one- way trips would average less than 10 per day, except during well workovers, which might average 10 to 20 one-way trips/day for several days depending on the operations that would be performed.

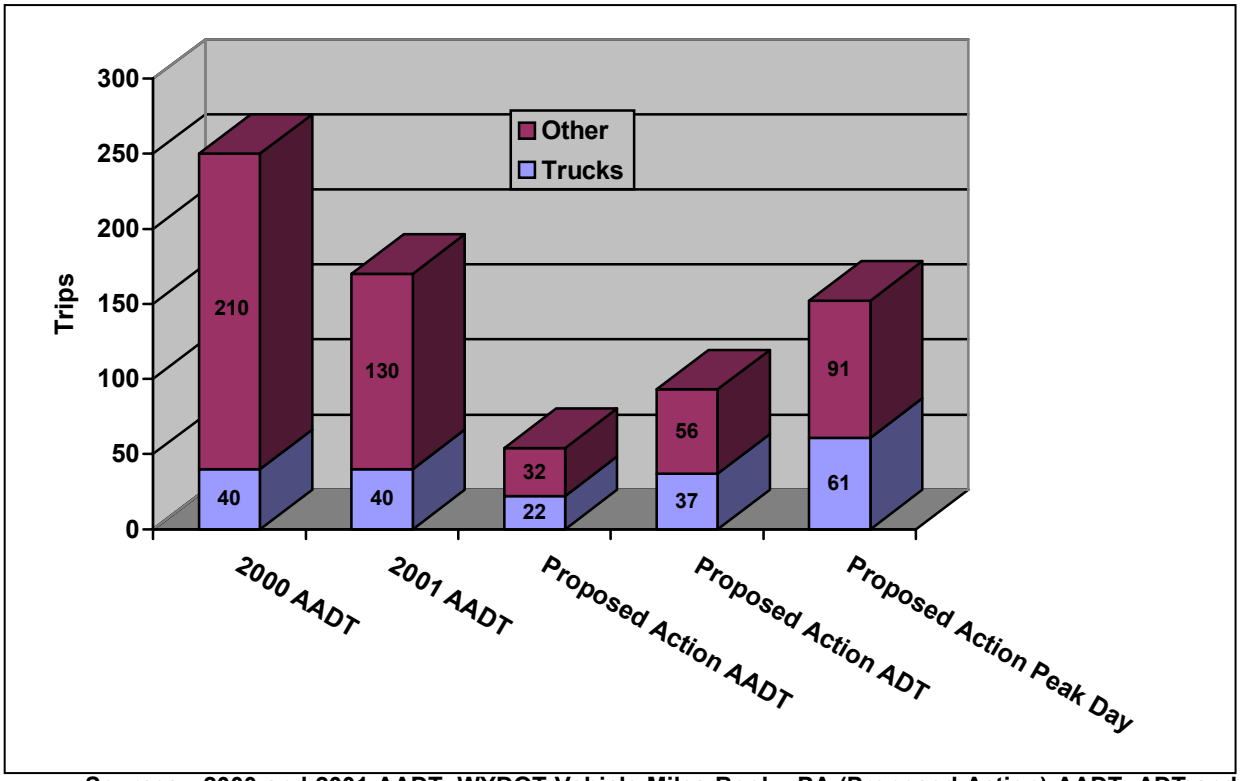
State Highways

Figure 4-3 contrasts estimated Proposed Action-related traffic estimates with recent Wyoming Department of Transportation AADT counts on WYO 430, at the turn-off to SCR 4-26. Estimated project- related traffic would be about 32 percent of 2001 AADT on WYO 430.

However, the Proposed Action AADT and 2001 AADT combined would still be less than 2000 levels for all traffic. Average-annual daily truck traffic would be 54 percent of both 2000 and 2001 levels.

Average daily traffic (ADT) during the 212-day drilling period would be about 55 percent of 2000 AADT. Truck traffic during that period would be about 93 percent higher than average annual daily truck traffic in both 2000 and 2001. Peak day traffic associated with the Proposed Action would be about 89 percent of 2001 AADT and 61 percent of 2000 AADT. Truck traffic on the peak day would be about 150 percent of average annual truck traffic during those years.

Figure 4-3. Proposed Action-Related Traffic on WYO 430 compared to 2001 and 2002 AADT



Sources: 2000 and 2001 AADT, WYDOT Vehicle Miles Book. PA (Proposed Action) AADT, ADT and Peak Day traffic, Blankenship Consulting LLC.

While WYO 430 could accommodate the estimated traffic volumes associated with the Proposed Action, overweight trucks would accelerate maintenance requirements on the highway and oversize trucks would pose safety concerns on this relatively narrow highway with narrow shoulders and steep side slopes, particularly during wet or icy conditions.

Additionally, the existing safety concerns associated with the approach to the SCR 4-26 turnoff from WYO 430 would be exacerbated by the additional heavy truck traffic. Similarly, the existing problem of trucks depositing gravel on WYO 430 as they exit SCR 4-26 would be exacerbated (Monturro 2003).

County Roads

The Proposed Action would result in substantial increases in traffic on the county roads that provide primary access to the CRPA (SCR 4-24 and 4-26) during the drilling and field development period. This increase in traffic, particularly heavy truck traffic, would accelerate deterioration of county roads. Excessive speed or use of the roads when they are muddy could damage the road surface. Deteriorated roads would result in accelerated road maintenance requirements for the Sweetwater County Road and Bridge Department and potential inconvenience and safety hazards for all road users. The Proposed Action-related increase in traffic would also exacerbate existing dust problems on SCR 4-24 (Gibbons 2003). The cost associated with accelerated road maintenance requirements and dust control on county roads may be offset by the Proposed Action-related ad valorem and sales and use tax revenues generated to county government. However, the availability of substantial project-related revenues would lag county road maintenance requirements by several years.

Internal Roads

Section 2.2.2.1 (Road Construction) describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the CRPA. According to the proponent, existing resource roads within the Brady and Jacknife Spring fields would be used to the extent feasible. Anadarko anticipates constructing or reconstructing an estimated 22.5 miles of resource roads to access new well locations. Anadarko would also be responsible for maintaining existing and new roads within the project area. New resource road locations would be identified in consultation with the BLM RO and be designed, constructed and maintained in compliance with the standards contained in BLM Manual 9113.

Some roads to well locations would be looped to provide additional egress options in compliance with the Brady Plant H^2S safety plan. Locations for loop roads would be identified in consultation with the BLM RO and road routes would be designed to consider slope, soils, vegetation and other sensitive resource issues.

4.13.1.2 No Action Alternative

Implementation of the No-Action alternative may result in increased traffic on State, county and resource roads because gas leases could be developed on private lands and potentially approved for BLM lands on a case by case basis. Transportation impacts similar to those described under the Proposed Action could occur, but at a reduced level. Based on the potential that a total of 48 wells could be developed on private and state lands, and the simulation used for the Proposed Action, an estimated 11,600 one-way trips (5,800 round-trips)

would be generated during each year of field development. This is an ADT of 55 trips during the 212-day drilling cycle or an AADT of 32, about 19 percent of 2001 AADT on WYO 430 at the turn-off to SCR 4-26. A projected 83 trips would occur on the peak day.

4.13.2 Mitigation

The following measures should further reduce potential impacts.

Mitigation for impacts on State highways would include:

- Coordination with WYODOT and the Sweetwater Road and Bridge Department to ensure that the approach to the SCR 4-16 turnoff from WYO 430 is adequate to handle tractor trailer combinations.
- Coordination with WYODOT and the Sweetwater Road and Bridge Department to ensure that the approach from SCR 4-26 to WYO 430 is paved or otherwise treated to allow trucks to shed gravel before entering the highway.

Mitigation for County Roads would include:

- Anadarko and contractor policies to reinforce speed limits and other traffic safety laws on SCR 4-26 and 4-24, and on operator-maintained roads within the CRPA.
- Assistance to the Sweetwater Road and Bridge Department in obtaining gravel, water and dust suppressant for application on SCR 4-26 and 4-24.

4.13.3 Residual Impacts

Minor increases in traffic associated with production, well and pipeline service and reclamation activities would continue throughout the life of the project.

4.14 HEALTH AND SAFETY

4.14.1 Impacts

4.14.1.2 Proposed Action

Potential health and safety effects associated with the Proposed Action would be similar in nature to those associated with existing conditions in the CRPA, but would occur at increased levels, especially during the drilling and field development phase of the project. Potential health and safety effects include hazards associated with natural gas development and operations; risk associated with vehicular travel on county, BLM and operator-maintained roads; firearms accidents during hunting season and by casual firearms use such as plinking and target shooting; and natural events such as range fires.

Health and safety impacts of the Proposed would include a relatively low risk to project workers from industrial accidents, firearm accidents and natural disasters. There would be a slight increase in risk of traffic accidents and range fires for the general public during drilling and field development and a negligible increase during field operations.

Occupational Hazards

The US BLM, OSHA, USDOT and Wyoming OGCC each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the operator and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area, and the relatively low use of these lands by others (primarily grazing permittees), occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

Pipeline Hazards

Increasing the miles of gathering and transmission pipelines within the CRPA would increase the chance of a pipeline failure. However, the relatively small amount of new pipeline associated with the Proposed Action, coupled with the low probability of failure and the remoteness of the project area would result in minimal risk to public health and safety. Signing of pipeline rights-of-way could reduce the likelihood of pipeline ruptures caused by excavation equipment - particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Hazardous Materials

Drilling, field development and production activities require use of a variety of chemicals and other materials, some of which would be classified as hazardous. Potential impacts associated with hazardous materials include human contact, inhalation or ingestion and the effects of exposure, spills or accidental fires on soils, surface and ground water resources and wildlife.

The risk of human contact would be limited predominately to CRPA operator and contractor employees. A Hazard Communication Program, Spill Prevention Control and Countermeasure (SPCC) Plans, and other mitigation measures described in Section 2.2.2.12.7 would reduce the risk of human contact, spills and accidental fires, and provide protocols and employee training to deal with these events should they occur.

H_2S

Although natural gas produced from the Almond formation would not contain H_2S, the existing Brady Plant, which is located in the CRPA, recovers sour gas which is subsequently reinjected to maintain pressure in the deeper Weber and Nugget formations in the Brady field. Copper Ridge project workers would be subject to risks associated with operating in a potential H_2S release area. The Plant is authorized under WDEQ Permit 31-023, and is covered by H_2S Contingency Plans.

Other Risks and Hazards

Highway and road safety impacts are discussed in Section 4.12 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.2.212.7.

The potential for firearms-related accidents would occur primarily during hunting season. The CRPA is believed to receive minimal hunting use and the increased activity during drilling and field development would be likely to further discourage hunting in the CRPA. Consequently the

risk of fire arms-related accidents should be minimal. During project operations, the relatively few personnel on site would also result in minimal risk of firearms-related accidents.

The risk of fire in the analysis area would increase under the Proposed Action. This is an unavoidable impact associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. However, this risk would be reduced by the placement of facilities on pads and locations that are graded and devoid of vegetation, which could lead, to wildfires. In the event of a fire, property damage most likely would be limited to construction or production-related equipment and range resources. Fire suppression equipment, a no smoking policy, shutdown devices and other safety measures typically incorporated into gas drilling and production activities would help to minimize the risk of fire. There would be a heightened risk of wildfire where construction activities place welding and other equipment in close proximity to native vegetation. Given the limited public use and presence in the project area, the risk to the public would be minimal. There would be a small in increase in risk to area fire suppression personal associated with the Proposed Action.

Based on the foregoing assessment, risks to public health and safety should not substantially increase as a result of the Proposed Action.

4.14.1.2 No Action

The health and safety risks identified under the Proposed Action could also occur under the No Action alternative, given that up to 48 wells could be developed on private and state land and on public land on a case by case basis. The magnitude of risk would be dependent on the level of development that would occur, but is likely to be less than that associated with the Proposed Action. Operators would be subject to the same health and safety standards and regulations as under the Proposed Action, therefore, substantial risks to public health and safety would not be anticipated under the No Action alternative.

4.14.2 Mitigation

Application of the following measures should further reduce potential impacts.

- The Brady Plant H_2S Contingency Plan should be reviewed to ensure that contingency procedures effectively address the planned drilling and field development activities.

- Anadarko should coordinate emergency response planning with the Sweetwater County Emergency Management Agency and provide documentation regarding compliance with Federal Hazardous Material Regulations and the Uniform Fire Code.

4.14.3 Residual Impacts

Risk to health and safety of workers, contractors and other users of the project area associated with industrial accidents, H_2S releases, transportation accidents, shooting accidents and natural disasters would remain for the life of the project. However, these risks would be small, given the remoteness of the area, the few employees and visitors anticipated and the proposed mitigation measures.

4-15. NOISE

4.15.1 Impacts

4.15.1.1 Proposed Action

Noise impacts on wildlife resources are addressed in Section 4.7. Noise levels associated with drilling, field development and operations activities may temporarily exceed 55 dBA, but the lack of human residences and the low level of non project-related human occupation of the project area would result in minimal noise impacts. Although noise impacts associated with compression facilities would be long term in duration, these same factors; lack of human residences and low human densities, would result in minimal compression noise impacts.

Implementation of the Proposed Action has the potential to create noise-generated impacts that emanate from machinery used during drilling and during construction of drill sites, pipelines, access roads and ancillary facilities, and from the operation of heavy trucks and related equipment. During field operations, noise would be generated by compression facilities, pumper trucks, road maintenance equipment and by well workover operations.

Noise associated with natural gas drilling, field development and field operations can affect human safety (at extreme levels) and comfort. Noise impacts can also modify animal behavior (see Section 4.7 for a discussion of the potential noise impacts to wildlife resources). The magnitude of noise impacts are contingent on a number of factors including the intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. A variety of heavy equipment and machinery commonly used during drilling, field development and production operations generate noise levels in excess of the 55 dBA maximum standard. Noise impacts created by these activities are short term, lasting as long as drilling, construction or field maintenance activities are performed at well sites, access roads, pipelines, and ancillary facilities. Under typical conditions, noise levels decline below the 55 dBA maximum standard at a relatively short distance (less than one mile from the source) depending on the factors outlined above.

Drilling, field development and field operations workers would be the only groups directly affected by Proposed Action-related noise disturbances for more than a brief period of time. These groups are subject to OSHA regulations regarding industrial noise protection. Grazing operators and recreation users of the area are few in number and would typically be affected by noise impacts only for the brief period required to pass by sites where drilling, field development and field operations occur.

Natural gas compression facilities would be a source of long-term noise impacts. These impacts would exceed the 55 dBA maximum standard at the compression site, but noise levels would be attenuated to below acceptable levels at a distance of 0.25 miles from the compression site (see Section 2.2.2.12.3). There are no residences located with in the CRPA and compression facilities would be located on private land. Therefore, field operations workers would be the only group affected by compression noise for other than a brief period of time.

Based on the foregoing and the noise mitigation measures contained in Section 2.2.2.12.3, noise impacts associated with the Proposed Action would be minimal.

4.15.1.2 No Action

Up to 48 wells could be developed on private and state lands and additional wells could be approved on public lands on a case-by-case basis. Therefore, implementation of the No Action Alternative could result in noise impacts similar to those associated with the Proposed Action, but noise generating activities would likely occur at fewer locations on public land. As with the Proposed Action, the lack of human residences and the low level of non project-related human occupation of the project area would result in minimal noise impacts.

4.15.2 Mitigation

Measures to further mitigate potential noise impacts include the following:

- In any area of operations (drill site, compressor site, etc.) where noise levels may exceed federal OSHA safe limits, Anadarko and its contractors would provide and require the use of proper personnel protective equipment by employees.

4.15.3 Residual Impacts

Although both intermittent (field maintenance and workover activities) and long-term (compression facilities) exceedences of 55 dBA noise levels would occur for the life of the project, the lack of human residences and the low human occupation of the project area would result in negligible noise impacts.

4.16 UNAVOIDABLE ADVERSE IMPACTS

4.16.1 The Proposed Action

The Proposed Action would disturb approximately 583 acres, thus increasing the potential for wind and water erosion before the land is revegetated. Other unavoidable adverse impacts are a short-term loss of vegetation and forage production, the temporary loss of livestock forage, short-term turbidity and some sedimentation at local drainages, short-term impacts to air quality /noise levels due to construction activities, short-term loss of pronghorn yearlong winter range, and possible temporary disruption of wildlife activities during construction.

4.16.2 No Action Alternative

Under the No Action Alternative, there would be reduced beneficial economic impacts to local, regional, and national economies.

4.17 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

4.17.1 The Proposed Action

Short-term use of the environment would facilitate and enhance natural gas production and stimulate local economies. Environmental impacts would be short-term and minimal. The proposed project would not adversely affect long-term use and would enhance long-term

productivity related to natural gas supplies.

4.17.2 No Action Alternative

There would be no changes in short-term use under the No Action Alternative. Long-term productivity in terms of natural gas production would be reduced.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.18.1 The Proposed Action

Irreversible or irretrievable commitments of resources would include the depletion of energy, materials, and manpower necessary to implement the Proposed Action.

4.18.2 No Action Alternative

There would be reduced resource commitments under the No Action Alternative.